

STRUCTURE OF THE MICROCARD (BASIC INSTRUCTIONS)

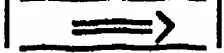
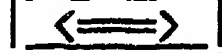
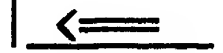


A02 = How to use the microcard		1	2	3		4
A01 = Structure of microcard					SIS	
B01 = Trouble-shooting chart	-A-	***X*	X*XXX	XXXXX	XXXXX	*XXXX X
	-B-	*XXXX	XXXXX	XXXXX	XXXXX	XXXXX XXX
	-C-	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX XXX
	-D-	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX XXX
	-E-	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX XX
	-F-	XXXXX	XXXXX	XXXXX	XXX	
	-G-	XXXXX	XXXXX	XXXX		
	-H-					
	-J-					
	-K-					
	-L-					
	-M-					
N01 = Service Information	-N-	*XXXX	XXXXX	XXXXX	XXX	XX XX*
		12345	67890	12345	67890	12345 678
			1		2	

- Index
- N28 = Table of contents and publication information
- 1 = Special features
- 2 = Safety and precautionary measures
- 3 = Test equipment and tools
- 4 = Installation position of components

- a. Read from left to right.
- b. Title of micropicture (appears on each coordinate).

E16	Product/component/test step	
	Coordinate	

c. Limits of section

			
Beginning	Mid-section	End	One-page section
A01			

HOW TO USE THIS MICROCARD

Trouble-shooting instructions for system:

Electronic ignition with knock control (EI-K).

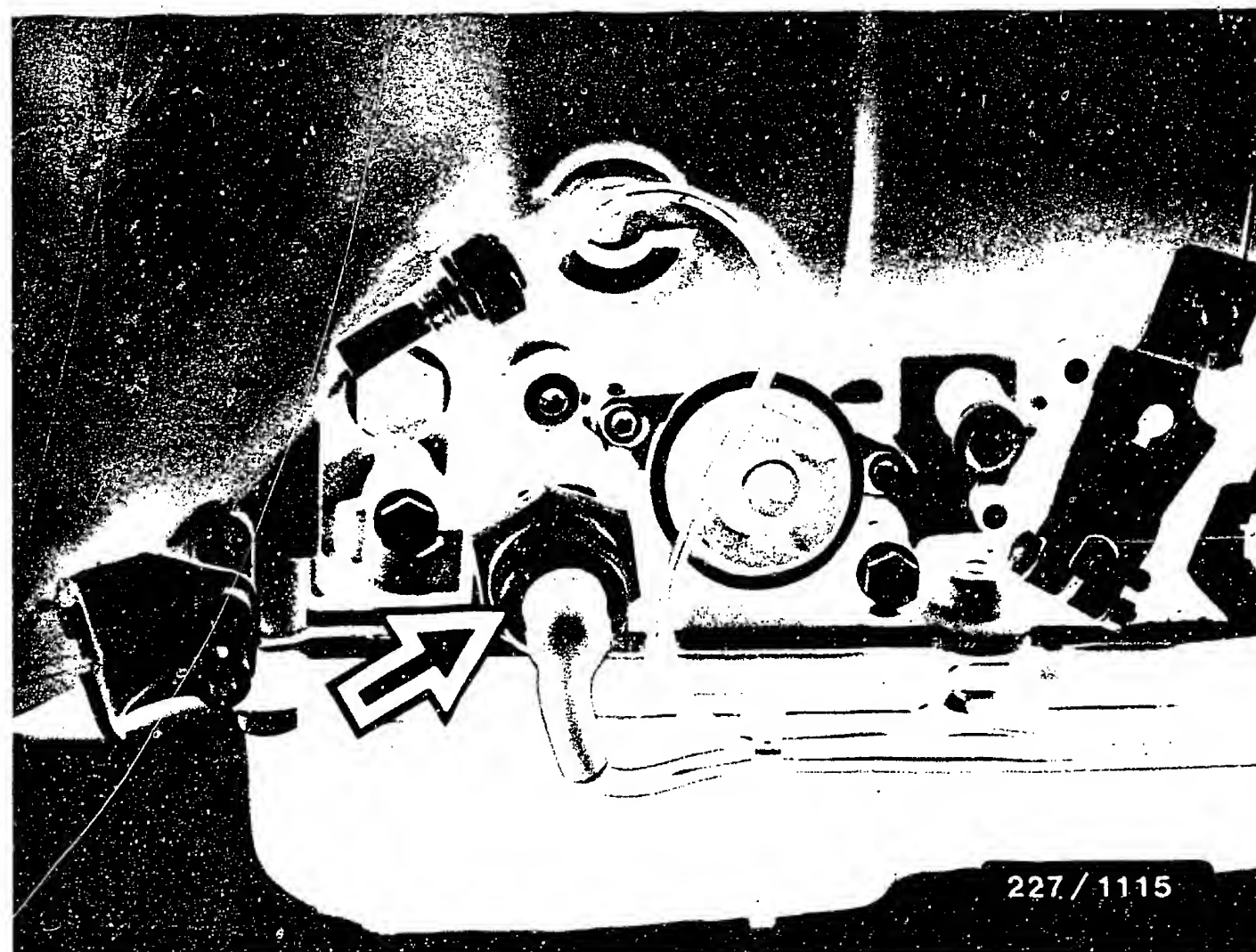
Descriptions, photos, terminal designations and special features refer to the vehicle:

PORSCHE 928 S4
with 5.0 l / 8-cylinder engine 8.86 ->
Engine type M 28/41 (manually shifted transmission)
Engine type M 28/42 (automatic transmission)

These basic instructions are detailed trouble-shooting instructions. They must not be used as vehicle-specific instructions. Caution! Descriptions and photos may differ from the vehicle-specific brief instructions.

Binding set values, terminal assignments and special features should be taken from the vehicle-specific brief instructions only. For brief instructions, see table of contents microcard KFZ-00..

A02		
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Arrow = Transmission overload-protection switch

SPECIAL FEATURES

Transmission overload protection

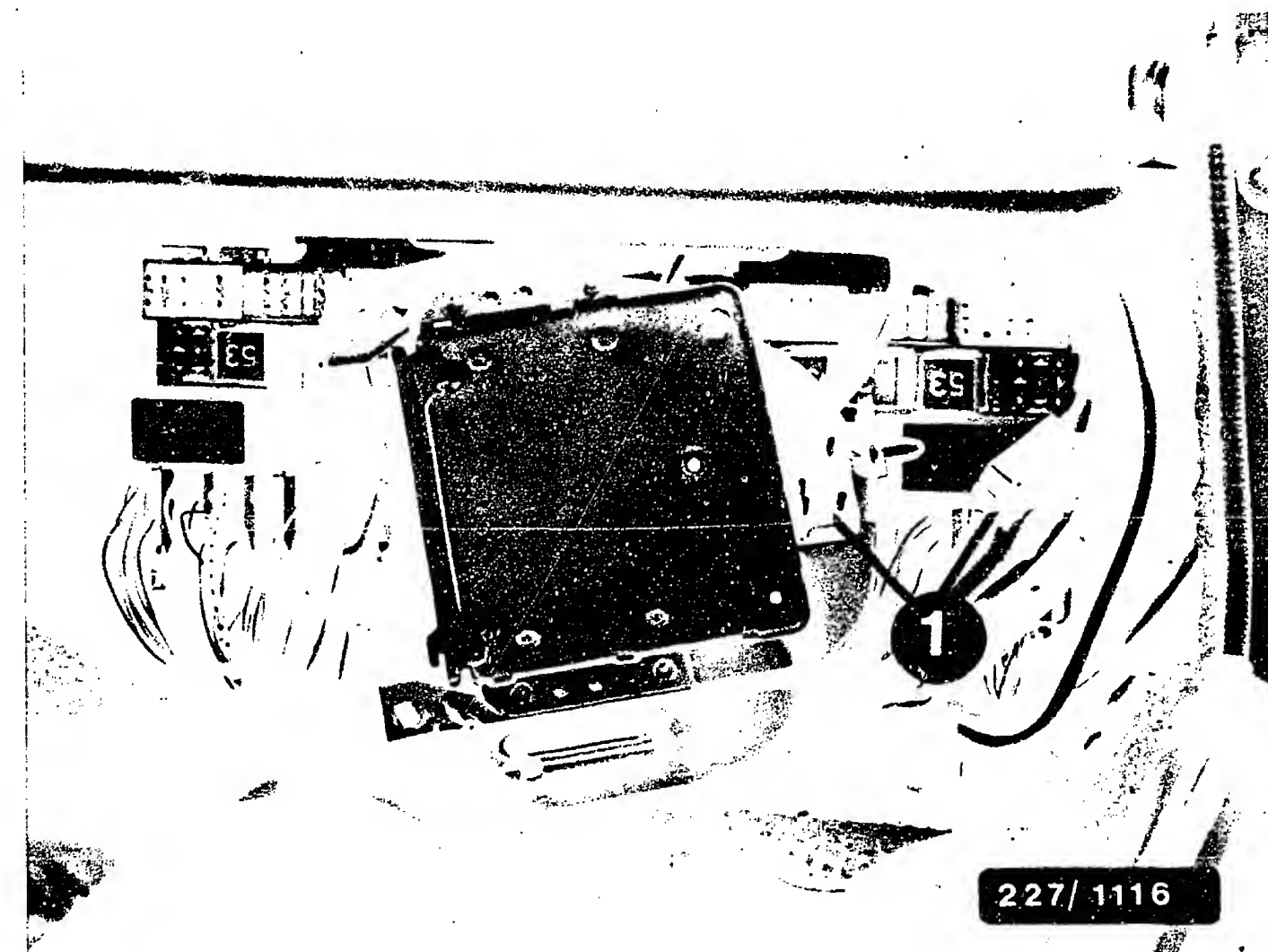
To prevent overloading of the transmission brake band B1 when shifting up and down, the ignition timing is briefly (ms range) retarded by 16° by the EI-K control unit. This results in a reduction in torque by approx. 25 %.

Control/triggering is by the transmission overload-protection switch.

See picture, Item 1.

Note:

Should the transmission overload-protection switch be diagnosed as defective by the EI-K control unit, rapid changes in engine speed, of the kind occurring during shifting, likewise trigger the retarding of the ignition (emergency program).

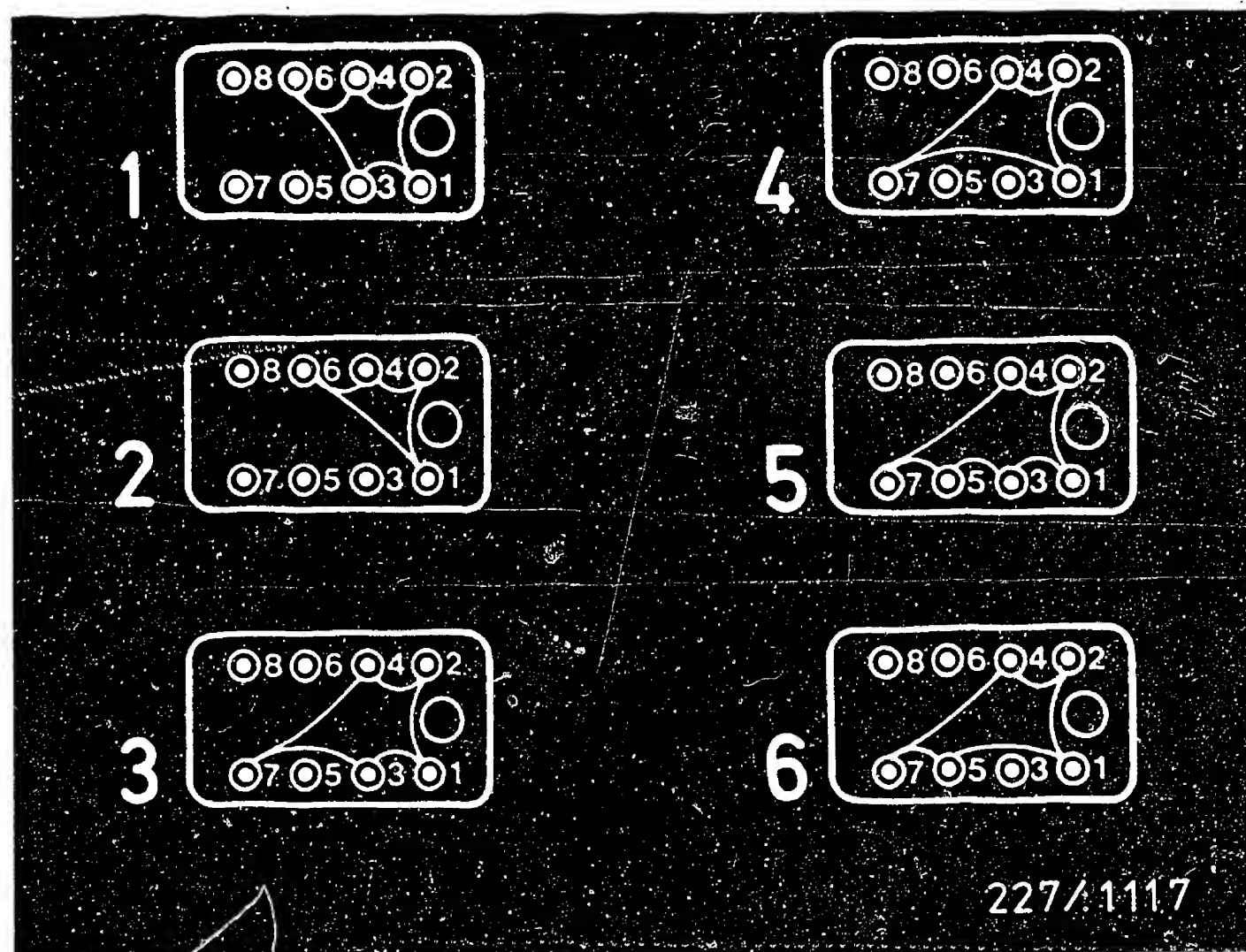


1 = Encoding plug

SPECIAL FEATURES (continued)

Encoding

Only one EI-K control unit is used worldwide. An encoding plug, which is mounted on the back of the control-unit, makes it possible to call up the appropriate map. See picture, Item 1. For examples of encoding, see next picture page.



SPECIAL FEATURES (continued)

Diagram
(Encoding
plug)

Version

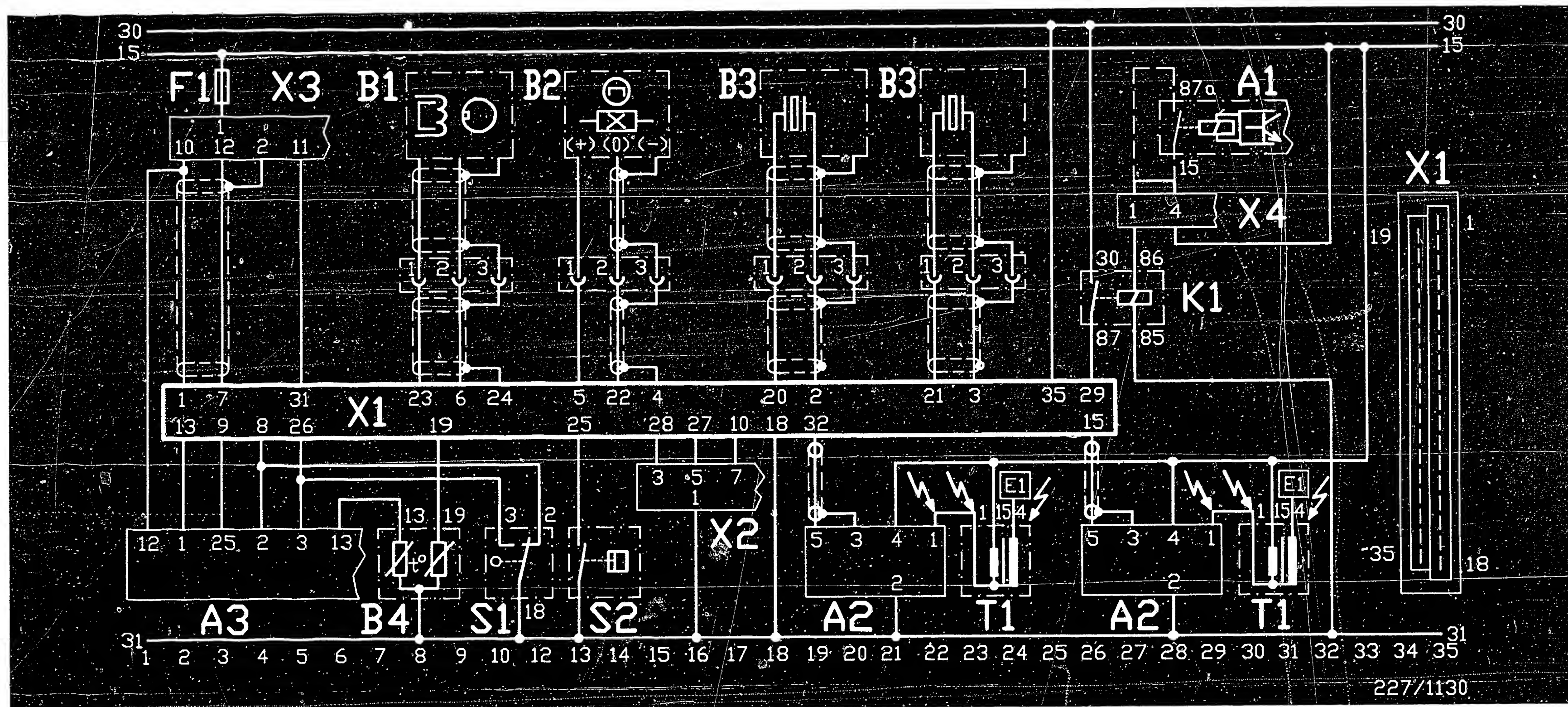
- | | | |
|---|---|--|
| 1 | = | ECE, Manually shifted transmission |
| 2 | = | ECE, Automatic transmission |
| 3 | = | USA, Manually shifted transmission |
| 4 | = | USA, Automatic transmission |
| 5 | = | Australia, Manually shifted transmission |
| 6 | = | Australia, Automatic transmission |

SAFETY AND PRECAUTIONARY MEASURES

Danger of accident on semi-conductor ignition systems.

The increased demands made on their ignition systems by modern engines, and the wish for freedom from maintenance, led sometime ago to manufacturers starting to equip their vehicles with semi-conductor ignition systems as original equipment.

In most cases, the performance of nearly all makes of such systems is higher than that of conventional systems, and further improvements are to be expected. This means that semi-conductor ignition systems have reached the point where contact with "live" components or terminals (whether on the primary side or the secondary side) can prove fatal. In this connection, we should like to point out that the VDE regulations, in particular VDE 0104/7.67 and/or the respective national regulations must be followed when testing or working on the ignition system.



Danger arrows: Warning: 400 V...25 kV

A1 = Alarm control unit
 A2 = Trigger box
 A3 = LH Jetronic control unit
 B1 = Pulse generator
 B2 = Hall-generator cylinder recognition
 B3 = Knock sensor
 B4 = Coolant-temperature sensor
 E1 = To high-voltage distributor
 F1 = Fuse

K1 = EI-K power-supply relay
 S1 = Throttle-valve switch,
 idle/full-load
 S2 = Transmission overload-
 protection switch
 T1 = Ignition coil
 X1 = EI-K control-unit plug
 X2 = Encoding plug
 X3 = Diagnostic plug

SAFETY AND PRECAUTIONARY MEASURES (continued)

The dangerous locations are identified by danger arrows with reference to the example of the terminal diagram of an electronic ignition system.

SAFETY AND PRECAUTIONARY MEASURES (continued)

During the compression test, either pull off the trigger-box plug or firmly connect terminal 4 of the ignition coil to ground using an extra cable (dangerous voltages, insulation damage at ignition coil, ignition distributor, ignition harness).

Note:

The extra cable must be suppressed with at least 2 k Ω , e.g. with sleeve-type suppressor (5 k Ω) 0 356 500 001.

Never start the engine without the battery securely connected (battery terminals tightened). Do not disconnect battery from vehicle electrical system with engine running.

Do not use a fast charger for starting the engine. Provide starting assistance only with a second 12 V battery and jump leads.

Caution! Owing to non-standardized requirements of vehicle manufacturers with regard to electronic products, we advise against using a 24 V battery for starting assistance.

When charging the battery in the vehicle or when providing starting assistance, follow the operating instructions for the fast charger as well as the instructions of the vehicle manufacturer.

Disconnect the battery from the vehicle electrical system before charging or fast-charging.

SAFETY AND PRECAUTIONARY MEASURES (Continued)

Incorrect polarity of the supply voltage, e.g. through incorrect connection of the battery, may lead to the destruction of trigger box and ignition coil as well as control unit.

Do not connect or disconnect wiring-harness plugs from control unit or trigger box with the ignition on.

Remove control units at temperatures above +80 °C (paint-drying installation).

Remove control units before performing electric welding work.

Do not replace the specified ignition coil (see part no.) with a different ignition coil.

No suppression capacitor may be connected to ignition coil term. 1.

Never connect the positive pole of the battery to ignition coil term. 1. Trigger box will be destroyed.

Do not short-circuit ignition coil term. 1 to ground (e.g. in order to switch off the engine). Ignition coil and possibly trigger box will be destroyed.

SAFETY AND PRECAUTIONARY MEASURES (Continued)

Ignition cable between ignition coil and high-voltage distributor term. 4 must not be disconnected during operation.

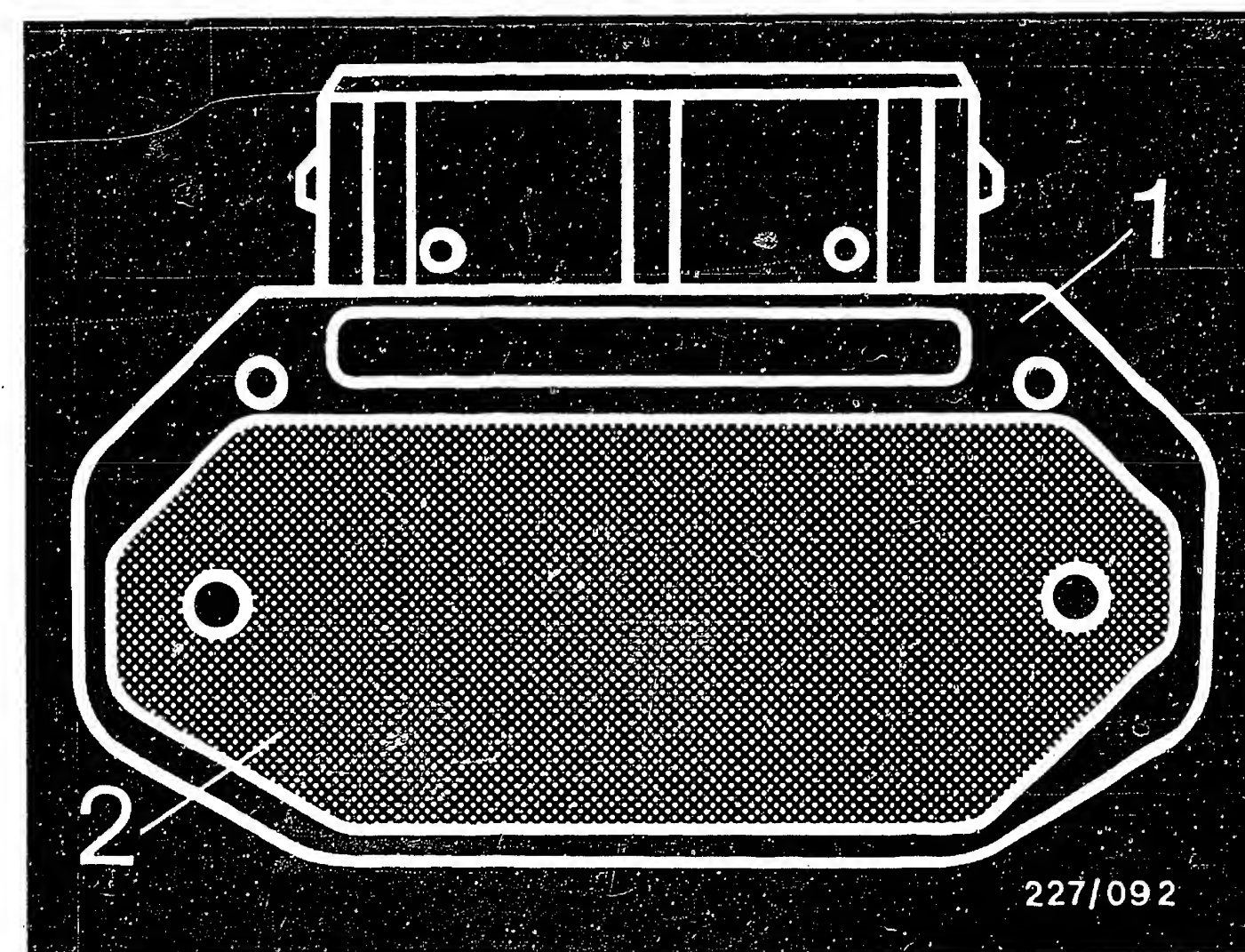
There must be no arcing between ignition coil term. 4 and ignition coil term. 1 and term. 15.

To prevent destruction of the trigger box, the secondary side of the ignition system must have at least 2 k Ω interference suppression, and the original distributor rotor with 1 k Ω must be installed.

Incorrect indication of engine speed, dwell angle and ignition point:

With this ignition system (trigger box with current limitation), there may be an incorrect indication of engine speed, dwell angle and ignition point on testers.

For further information, see Coordinates N10



1 = Trigger box

2 = Base plate

Before mounting the trigger box, coat the base plate with thermal-conduction paste.

Apply thermal-conduction paste only with a suitable object (screwdriver, matchstick etc).

Do not bring thermal-conduction paste into contact with painted parts.

TEST EQUIPMENT AND TOOLS

Motortester e.g. MOT 206	0 684 000 206
Pulse shaper (required for measuring the primary voltage with MOT 201, 206 and 400)	1 684 463 154
Adapter lead	1 684 463 158 ... 189
5 k Ω sleeve-type suppressor	0 356 500 001
Ohmmeter ETE 014.00 or e.g. Pontavi Wh 2	0 684 101 400 commercially available
Voltmeter e.g. ETE 014.00	0 684 101 400
Test leads (for correct connection of test equipment at connectors)	KDZS 0004 KDZS 0005
Test prod, black Test prod, red (for correct connection of test equipment at connectors)	1 684 485 034 1 684 485 035
Clamp-type test prods (for connection at diagnostic plug)	commercially available

TEST EQUIPMENT AND TOOLS (continued)

Auxiliary lead for user fabrication (for jumpering the EI-K power- supply relay) Parts required: approx. 100 mm cable 2.5 mm ² 2 blade terminals	8 784 480 011
Thermal-conduction paste	5 942 860 003

INSTALLATION POSITION OF COMPONENTS

EI-K control unit (top picture, Item 1) and LH-Jetronic control unit (top picture, Item 2) are in the front-passenger footwell on the right.

How to remove :

Fold back footmat in front-passenger footwell.

The diagnostic connection (top picture, Item 3) is on the control-unit holding plate.

The trigger boxes (center picture, Item 1) are under a cover on the lid-lock cross wall on the left, center picture, Item 2.

The battery is in the luggage compartment at the rear left.

How to remove :

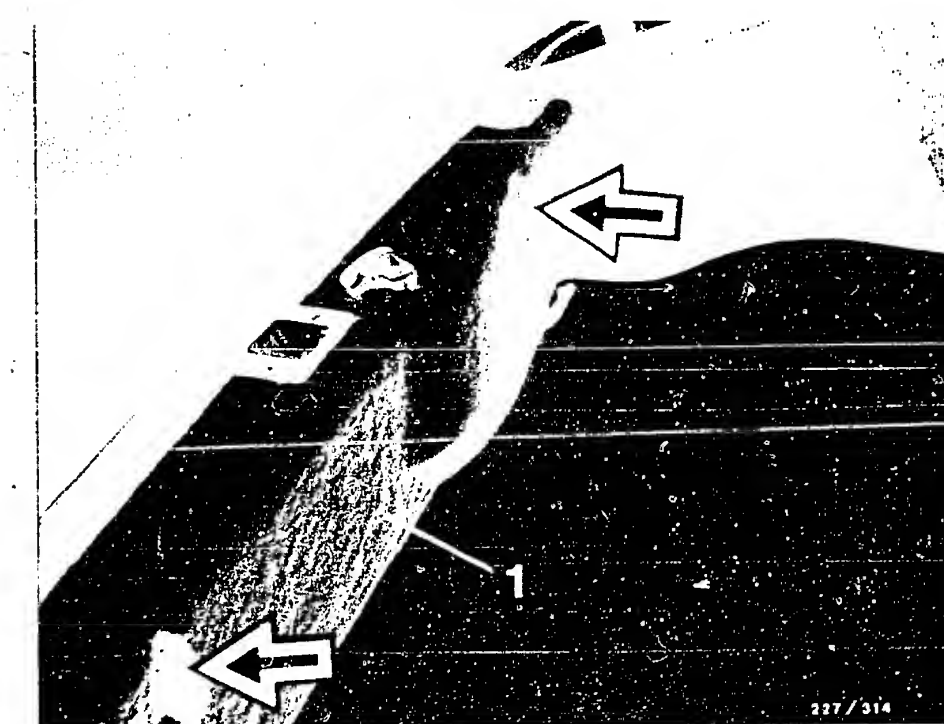
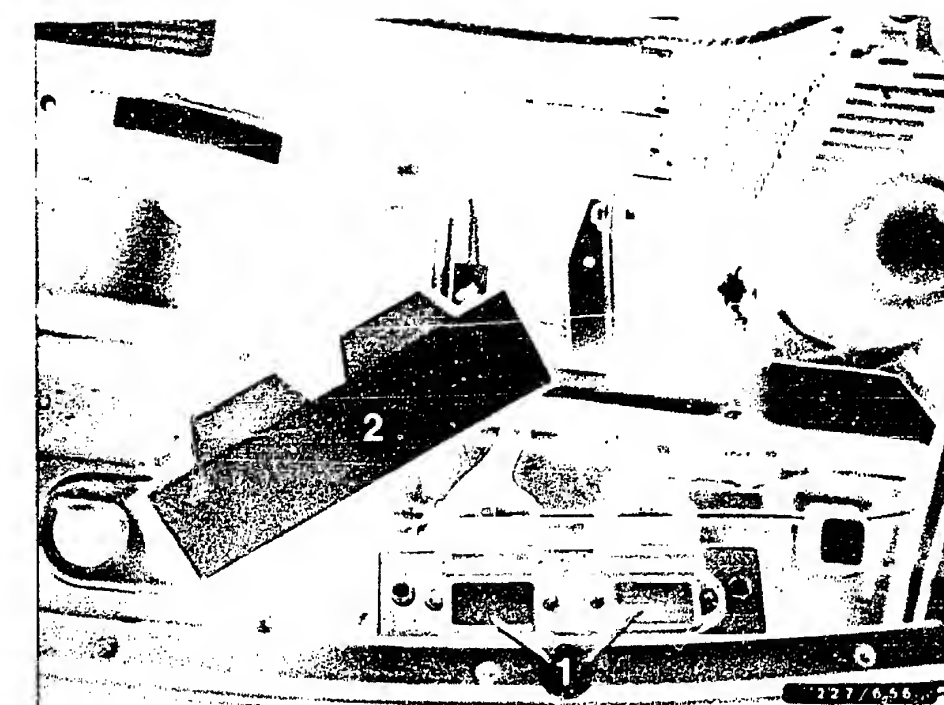
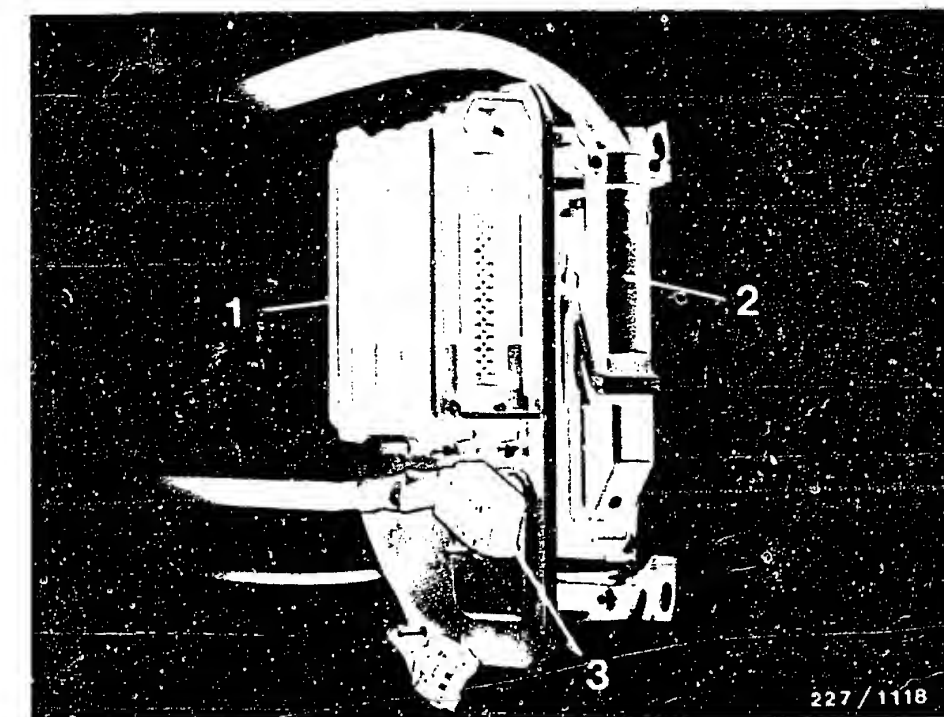
Fold back mat.

Loosen knurled screw (latched closure). See bottom picture, arrows.

Remove tool plate (bottom picture, Item 1).

Take out spare wheel.

Remove battery cover.



INSTALLATION POSITION OF COMPONENTS (CONTINUED)

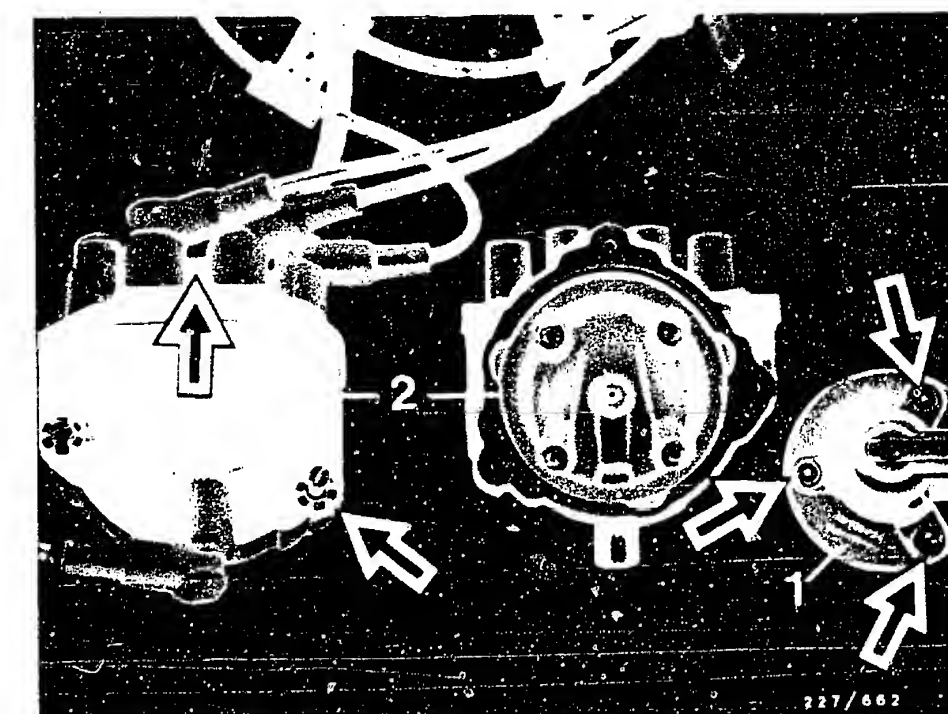
For fastening of high-voltage distributor rotors (Item 1) and high-voltage distributor cap (Item 2), see top and center pictures, arrows.

In centre picture, cap and rotor are removed.

Note :

On right in direction of travel: Cylinders 1 - 4

On left in direction of travel: Cylinders 5 - 8



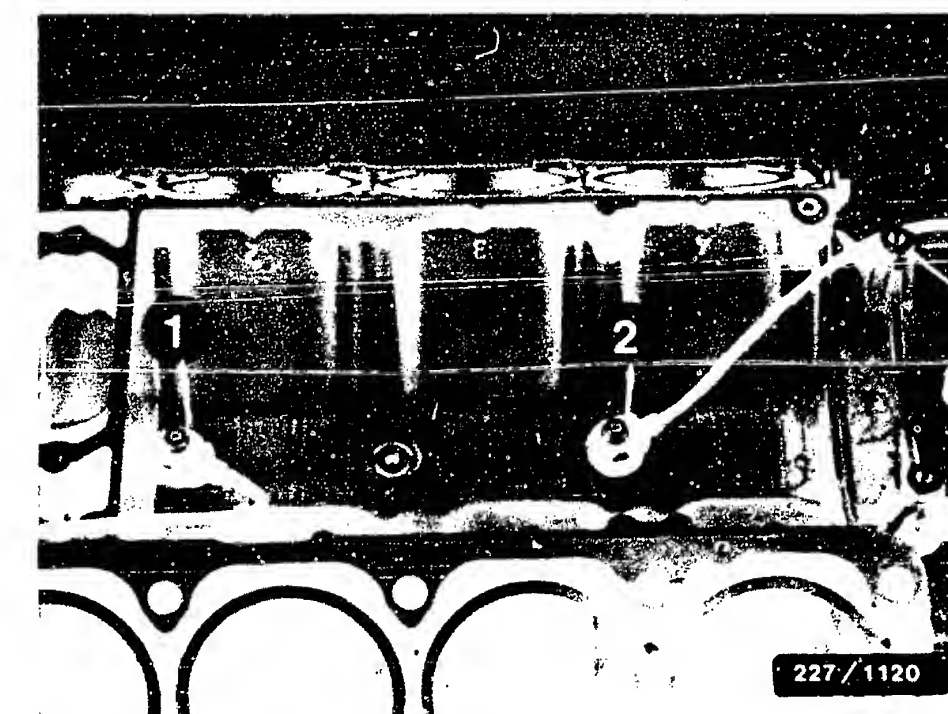
The knock sensors are fastened on the upper part of the crankcase using special bolts without spring lock washers, tooth lock washers etc. See bottom picture.

How to remove :

Remove intake-air distributor and intake manifold (takes approx. 6 hours).

1 = Front knock sensor for cylinders 1, 2, 5, 6

2 = Rear knock sensor for cylinders 3, 4, 7, 8



INSTALLATION POSITION OF COMPONENTS (CONTINUED)

Hall-generator cylinder recognition is behind the camshaft gear of cylinder bank 1...4 (on right in direction of travel).
See top picture, arrow.

How to remove :

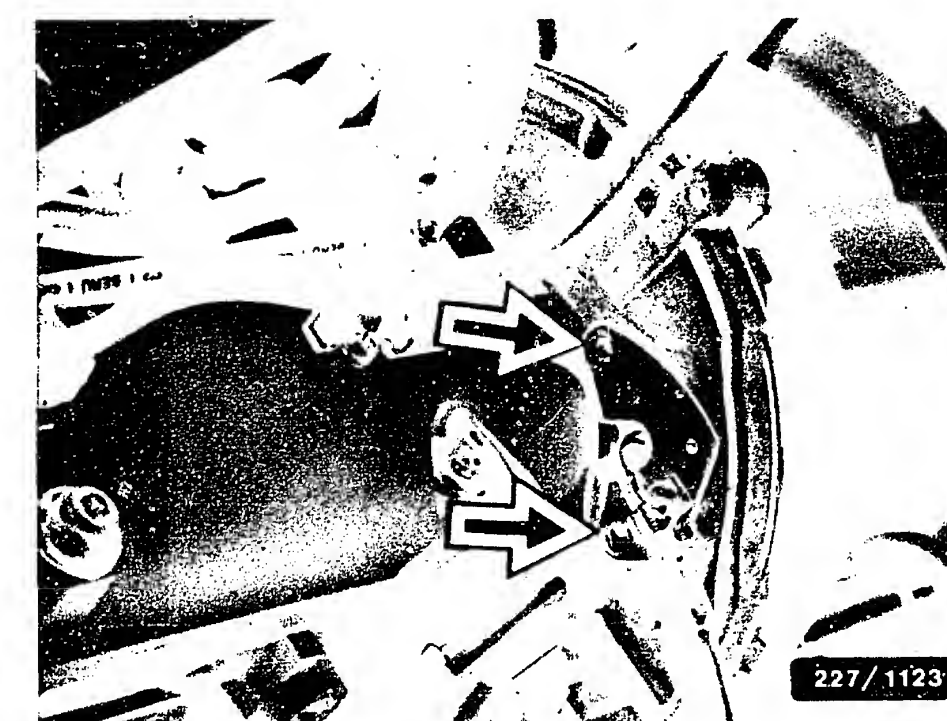
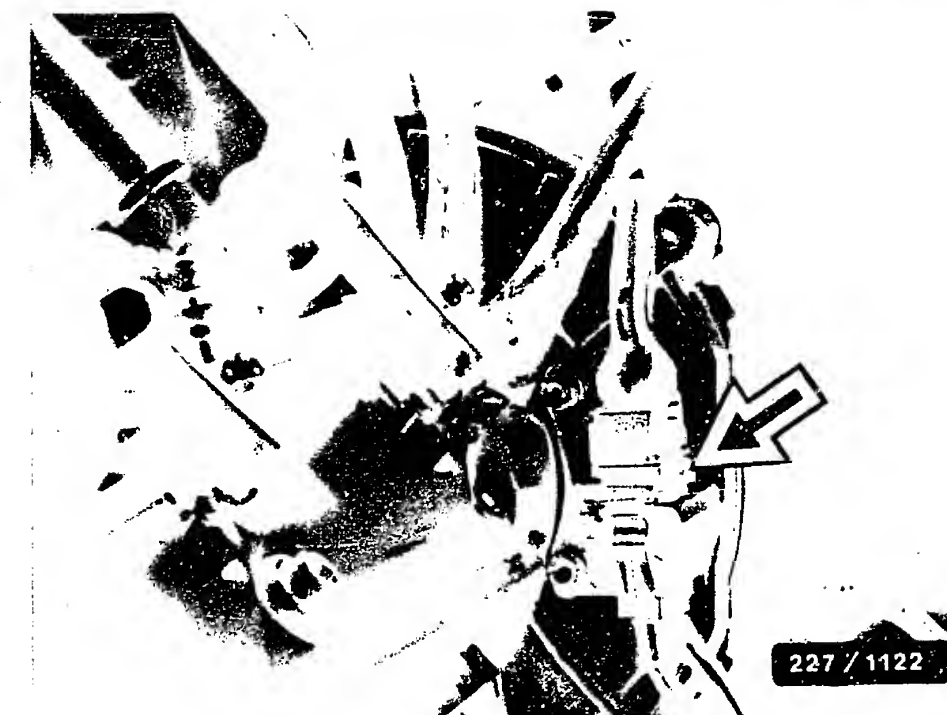
Remove air-filter intake hose on right.

Unscrew transport strap.

Unscrew Hall-generator fastening screws.

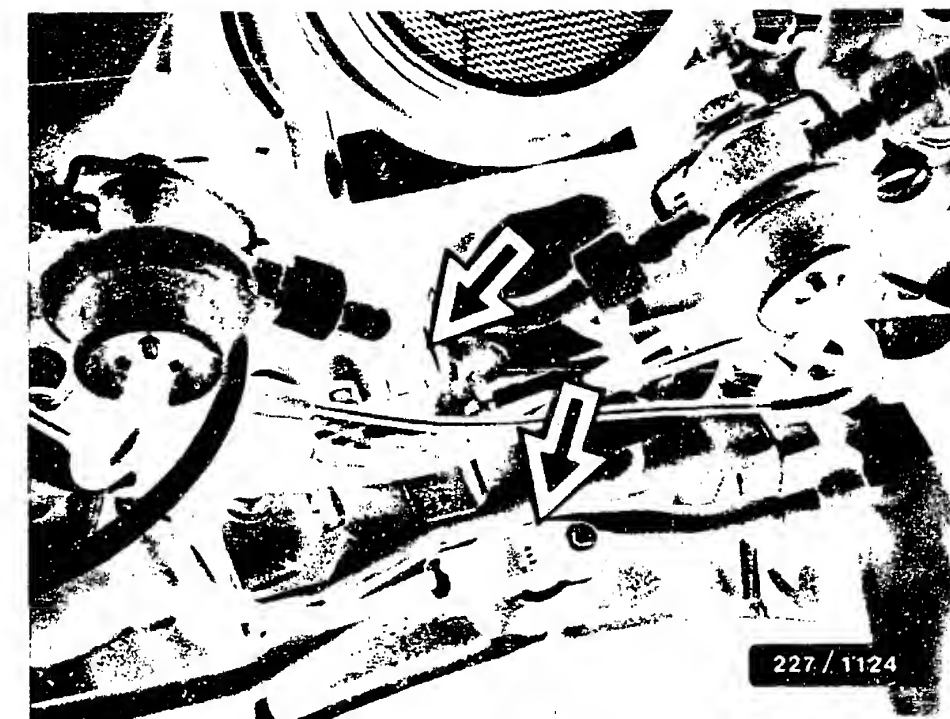
See center picture, arrows.

Engine-temperature sensor is behind oil filler cap.
See bottom picture, arrows.

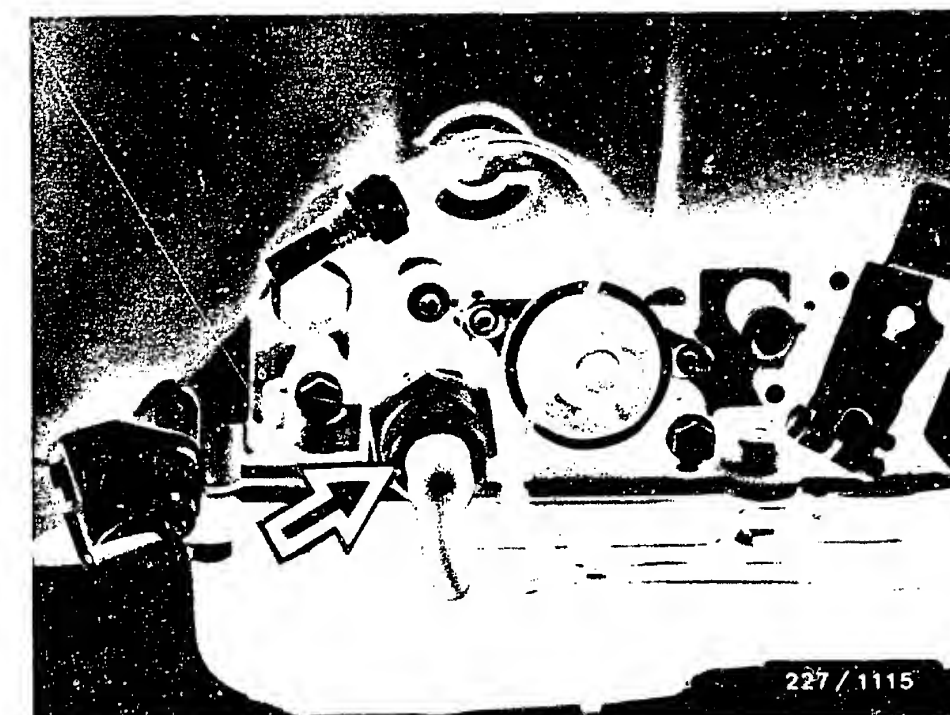


INSTALLATION POSITION OF COMPONENTS (CONTINUED)

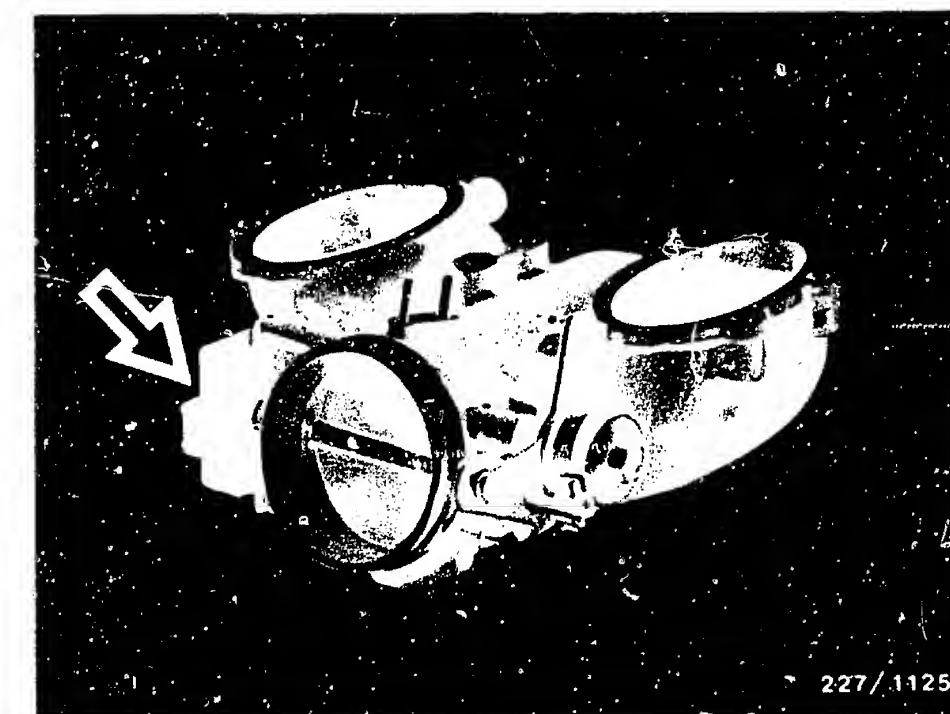
Engine-speed and reference-mark sensors including plug connectors are on the engine block at the rear, below the air filter. See top picture, arrows.



Transmission overload-protection switch is on the left-hand side of the transmission. See center picture, arrow.



Throttle-valve switch is on the throttle-valve assembly. See bottom picture, arrow.

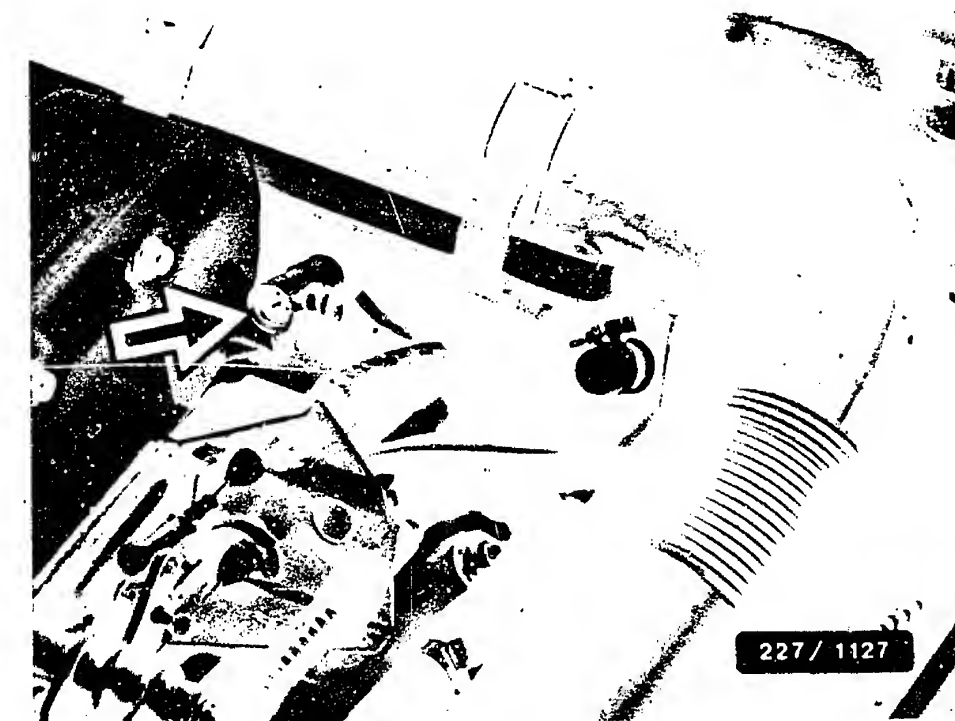


How to remove :

Remove intake-air distributor and intake manifold.
(Takes approx. 6 hours).

INSTALLATION POSITION OF COMPONENTS (CONTINUED)

Test connection for adapter lead (TDC pickup) is on the left-hand side of the engine in front of the air filter.
See top picture, arrow.

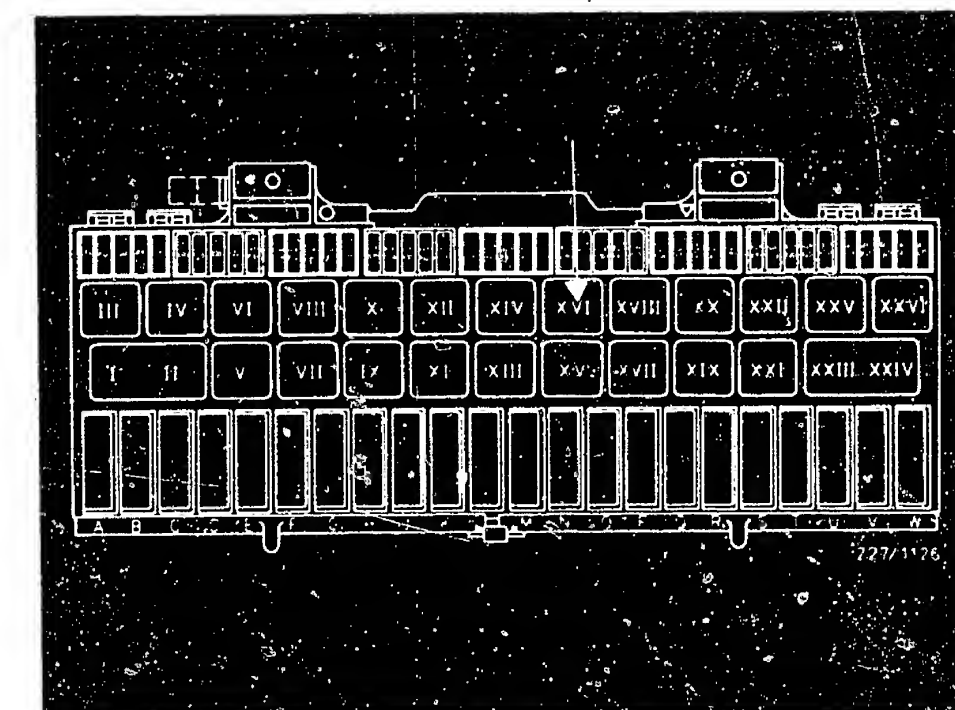


Ignition power-supply relay is in the central-electrics box.
See bottom picture, arrow.

How to remove :

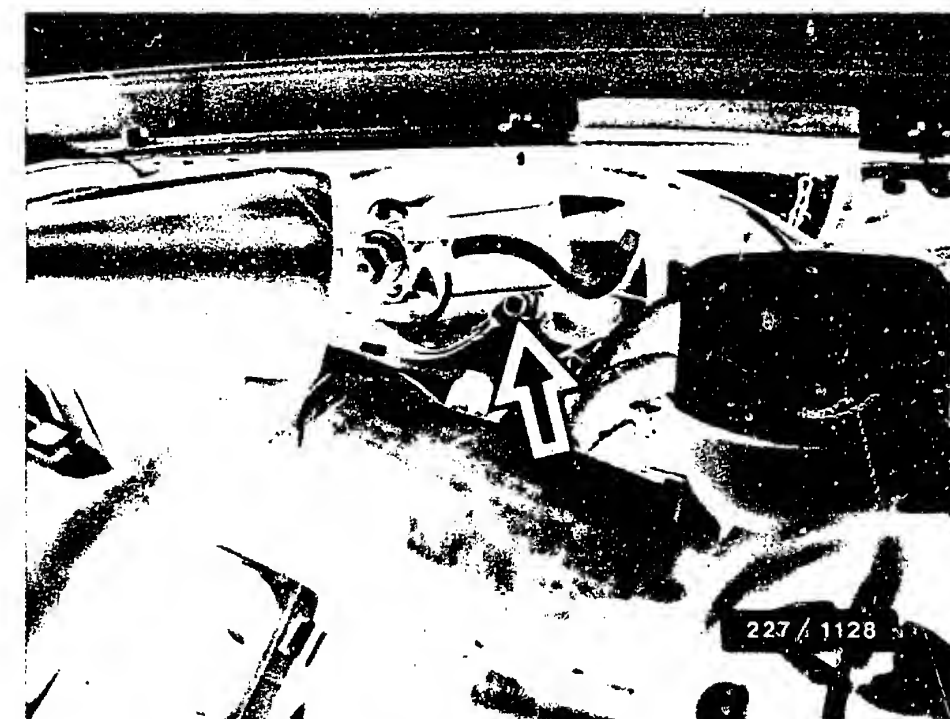
Fold back floor mat in front-passenger footwell.

Swing floor board upwards.

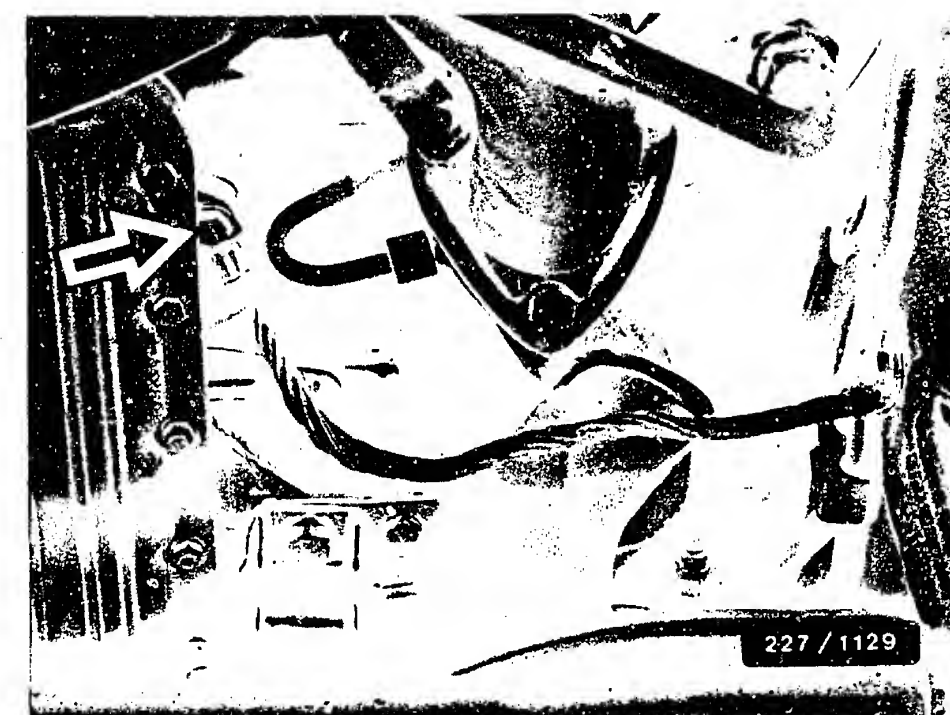


INSTALLATION POSITION OF COMPONENTS (CONTINUED)

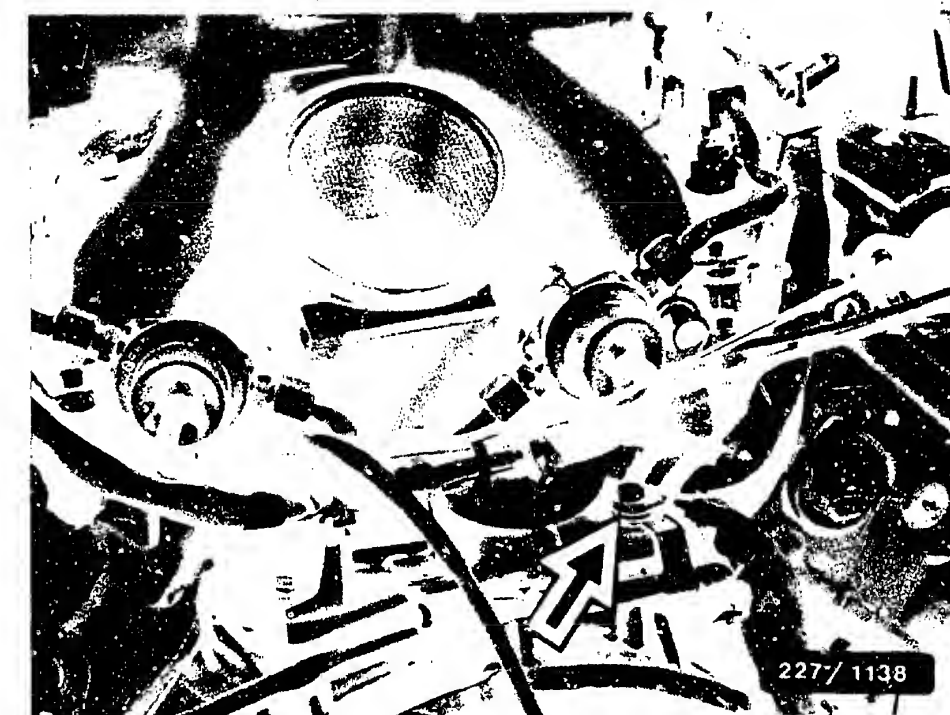
Trigger-box ground is above right-hand ignition coil.
See top picture, arrow.



Engine ground is on right between engine and body.
See center picture, arrow.



Electronics ground is under fuel-pressure regulator/fuel-pressure damper.
See bottom picture, arrow.



HOW TO USE TROUBLE-SHOOTING CHART AND TROUBLE-SHOOTING PROGRAM

The TROUBLE-SHOOTING CHART starts on coordinate B04 and contains customer complaints (fault symptoms) with several possible causes (component faults) in each case as well as coordinate references for detailed trouble-shooting. If no coordinate reference is given, this is a cause for which no test instructions are required.

Components that are checked by the self-diagnosis or with the universal test adapter are not listed in the trouble-shooting chart.

If the customer complaint is clear, proceed with trouble-shooting in the given order of possible causes one after the other and step by step.

Always start trouble-shooting with the self-diagnosis (if applicable) or with the universal test adapter (if provided). Only then continue with the trouble-shooting chart.

If the customer complaint is not clear, check all the causes listed in the trouble-shooting chart. To prevent possible incorrect measurements, check all causes in the order given (owing to the interlinking of test steps).

HOW TO USE TROUBLE-SHOOTING CHART AND TROUBLE-SHOOTING PROGRAM (CONTINUED)

The TROUBLE-SHOOTING PROGRAM contains all system and component checks mentioned in the trouble-shooting chart. It is divided into three rows of boxes.

The left-hand column contains test instructions and set values.

The center column contains instructions on trouble-shooting and fault rectification. The right-hand column contains the illustrations/terminal diagrams belonging to the text, with explanations.

If the questions in the left-hand column can be answered clearly with "yes", continue trouble-shooting with the next box down.

If the answer to the question is "no", branch to the center column and carry out the tests in the order given there.

After the fault has been rectified, repeat the test as a check.

USING THE TROUBLE-SHOOTING CHART AND
 TROUBLE-SHOOTING PROGRAM (continued)

TEST REQUIREMENTS:

- Battery fully charged
- Engine mechanically O.K.
(e.g. compression, valve clearance etc.)
- Engine at normal operating temperature, approx. +80°C
(if necessary)
- Correct seating of all connectors of wiring harness
- Fuel system O.K.

TROUBLE-SHOOTING CHART

Customer complaint (fault symptoms)

1. Starting motor operates, engine fails to start or starts only with difficulty.
2. Engine starts but then dies.
3. Idle problems
(Engine speed, exhaust gas).
4. Poor throttle take-up, flat spot during acceleration.
5. Engine missing
(Ignition, injection).
6. Maximum engine power/ top speed not reached.
7. Fuel consumption too high.
8. Engine running on (dieseling).
9. Engine pinging/knocking.
10. Engine overheating.
11. Fault lamp.

											Cause (component fault)	Coord.
*	*	*	*	*	*	*	*	*	*	*	Self-diagnosis	B07
*				*							High-tension side	D07
*											Firing sequence	—
*				*							Ignition coil	D09
*											Trigger-box voltage	D13
*											Primary-circuit voltage	D15
*											EI-K control-unit voltage	D17
*											Insulation of engine-speed and reference-mark sensors	D23

TROUBLE-SHOOTING CHART (continued)

Customer complaint (fault symptoms)

1. Starting motor operates, engine fails to start or starts only with difficulty.
2. Engine starts but then dies.
3. Idle problems (Engine speed, exhaust gas).
4. Poor throttle take-up, flat spot during acceleration.
5. Engine missing (Ignition, injection).
6. Maximum engine power/top speed not reached.
7. Fuel consumption too high.
8. Engine running on (dieseling).
9. Motor pinging/knocking.
10. Engine overheating.
11. Fault lamp.

Cause (component fault)										Coord.	
*										Internal resistance of engine-speed and reference-mark sensors	D25
*										Voltage of engine-speed and reference-mark sensors	D27
*										Energization of trigger boxes	E01
*										Contact resistances (Primary side)	E05
			*							Trigger-box voltage (Engine idle)	E07
			*							Ignition-coil voltage (Engine idle)	E09
			*							Primary voltage	E11

For production reasons:
continued on the following
coordinate.

USE OF SELF-DIAGNOSIS, SELF-DIAGNOSIS TEST TABLE, AND SELF-DIAGNOSIS TROUBLE-SHOOTING PROGRAM

The control unit installed in this vehicle incorporates self-diagnosis. For this reason, trouble-shooting must start with self-diagnosis.

Activation of self-diagnosis is described starting on Co-ordinate B15. The self-diagnosis test table starting on B19 includes:

- Fault indication (flashing code)
- Components or system functions inspected
- Test instructions/conditions
- Connection terminals
- Set-value information
- Co-ordinate information for trouble-shooting and elimination in the subsequent self-diagnosis trouble-shooting program.

USING THE SELF-DIAGNOSIS, SELF-DIAGNOSIS TEST TABLE AND SELF-DIAGNOSIS TROUBLE-SHOOTING PROGRAM (Continued)

The self-diagnosis trouble-shooting program is divided into three columns starting at Coordinate C01.

The left-hand column contains test instructions and set values.

The center column contains information on trouble-shooting and on how to rectify the fault.

The right-hand column contains the illustrations/terminal diagrams belonging to the text, together with explanations.

If the questions in the left-hand column can be answered conclusively with "yes", continue trouble-shooting with the next box down.

If the answer to the question is "no", branch to the center column and carry out the tests in the order given there.

After rectifying a fault, repeat the test as a check.

If the self-diagnosis indicates a fault, but no system fault or component fault was found during trouble-shooting, try replacing the control unit.

If no more fault is indicated in self-diagnosis and the customer complaint has still not been eliminated (symptom of trouble), continue trouble-shooting with the trouble-shooting chart starting at Coordinate B04.

HOW TO USE SELF-DIAGNOSIS, SELF-DIAGNOSIS TEST
TABLE AND TROUBLE-SHOOTING PROGRAM (continued)

Test conditions:

- Cable connection from battery positive through LH-Jetronic power-supply relay term. 30 to EI-K control-unit plug term. 35 O.K. (open circuit).
- Cable connection from battery positive through ignition power-supply relay term. 30 and term. 87 to EI-K control-unit plug term. 29 O.K. (open circuit).

Cable connection from battery negative to EI-K control-unit plug term. 18 O.K. (open circuit).

- Cable connection from EI-K control-unit plug term. 7 to diagnostic plug term. 12 O.K. (open circuit, short circuit to ground).
- Cable connection from EI-K control-unit plug term. 1 through diagnostic plug term. 10 to LH-Jetronic control-unit plug term. 12 O.K. (open circuit, short circuit to ground).

For production reasons:
continued on the following
coordinate.

HOW TO USE SELF-DIAGNOSIS, SELF-DIAGNOSIS TEST TABLE AND TROUBLE-SHOOTING PROGRAM (continued)

Evaluation of fault code (voltage pulses)

The self-diagnosis is output in the form of a fault code.

The fault code may consist of 1, 2, or 4 fault groups.

Fault code 2 "end of fault output" e.g. consists of 1 fault-code group. See top picture.

Fault code 2 5 "no fault stored" e.g. consists of 2 fault-code groups. See center picture.

Fault code 2 1 3 4 "cylinder recognition" e.g. consists of 4 fault code groups. See bottom picture.

The fault code is detected without special test equipment using an ANALOG VOLTMETER (pointer instrument) and is evaluated in the form of deflections of the pointer.

Voltmeters with digital displays cannot be used. Therefore, the test operator counts the voltage pulses (deflections of pointer) on the voltmeter.

Note:

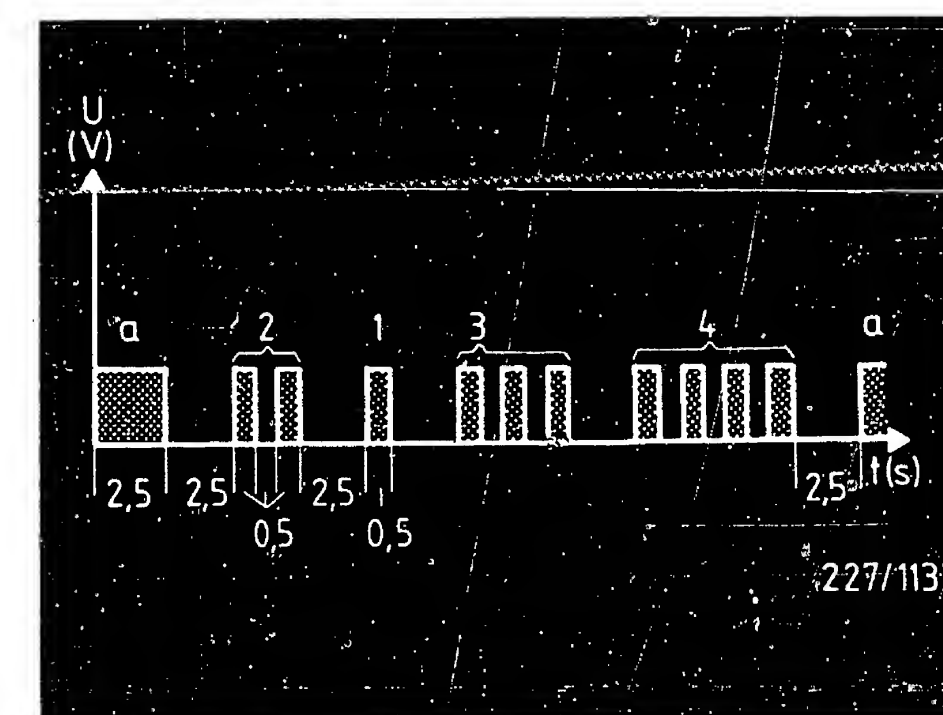
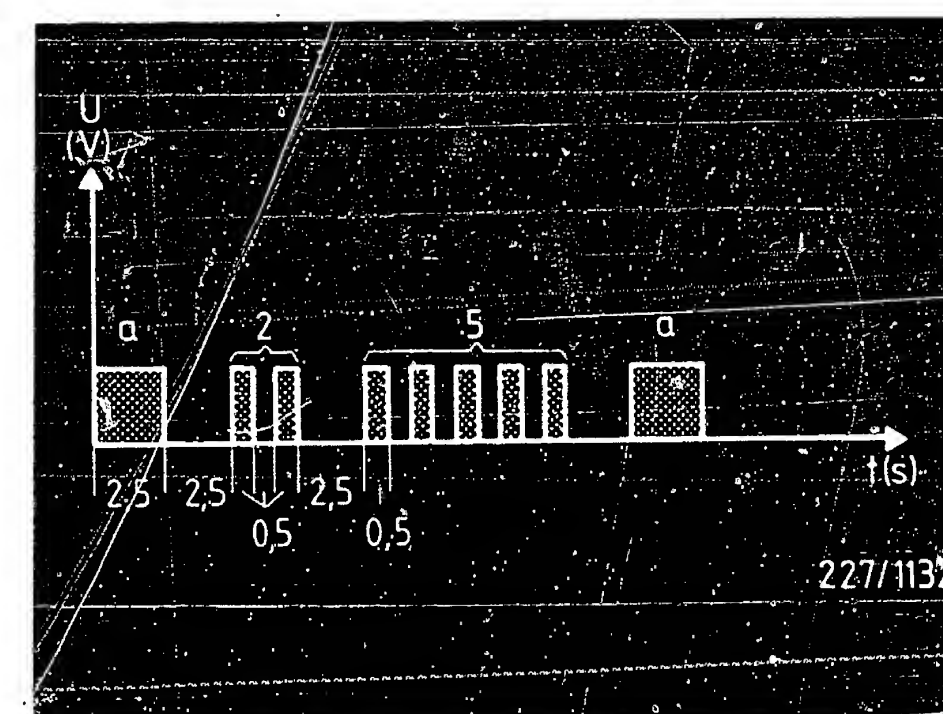
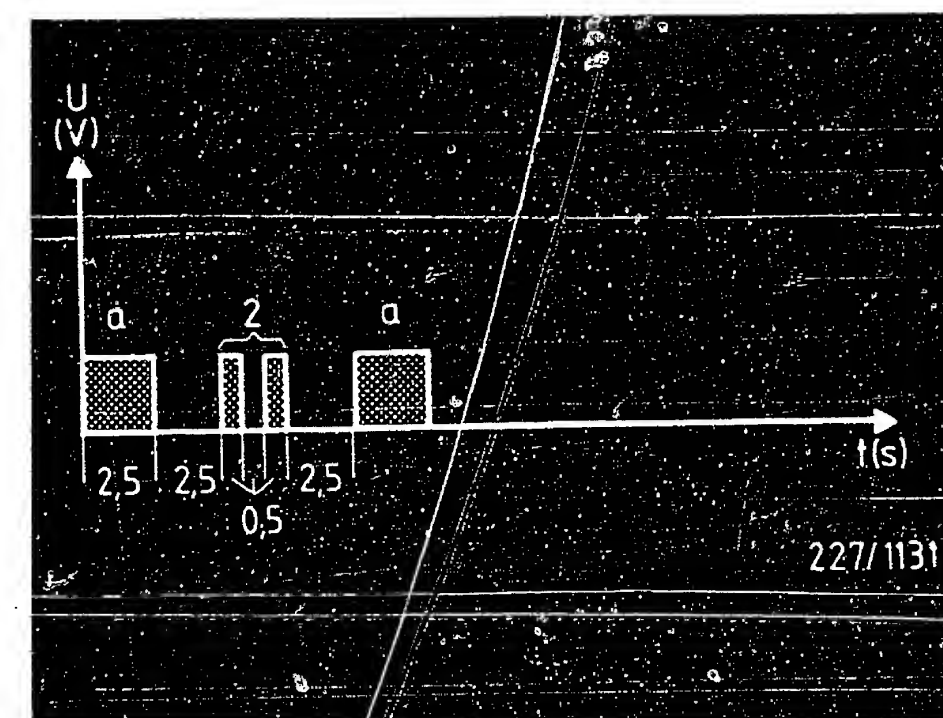
Shaded area in picture means voltage pulse present.

a = Starting signal (start of transmission of fault code).

After the starting signal (voltage pulse present) and a subsequent pause (voltage pulse not present) of approx. 2.5 seconds in each case, the fault code is transmitted. For example, see bottom picture.

There is a pause (voltage pulse not present) of approx. 2.5 seconds between the fault-code groups.

After the transmission of the last fault-code group, there is a pause of approx 2.5 seconds. The bottom picture shows, as an example, the fault code 2 1 3 4 .



HOW TO USE SELF-DIAGNOSIS, SELF-DIAGNOSIS TEST TABLE AND TROUBLE-SHOOTING PROGRAM (continued)

The self-diagnosis is able to show both static and sporadic faults:

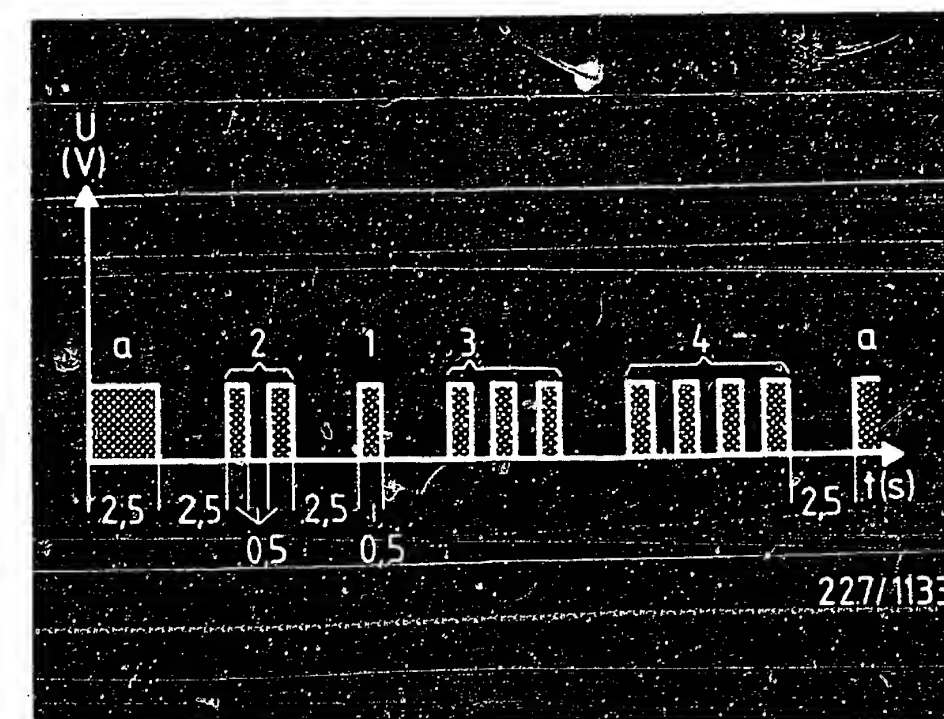
Static fault means: Fault has been detected once only and has remained.

Sporadic fault means: Fault has occurred only occasionally (e.g. loose contact). Sporadic faults need not be present during the test.

Static or sporadic faults can be detected by the fact that there is a "1" or "2" in second place in the fault code (not in the case of fault codes 1, 1 5, 2, 2 5).

Example: 2 1 3 4 = static fault. See picture.

Example: 2 2 3 4 = sporadic fault



HOW TO USE SELF-DIAGNOSIS, SELF-DIAGNOSIS TEST TABLE AND TROUBLE-SHOOTING PROGRAM (continued)

How to activate the self-diagnosis

Owing to the priority control of the LH - and EI-K control units, the output of the self-diagnosis starts with the LH-Jetronic (recognisable by the fact that the fault code starts with "1").

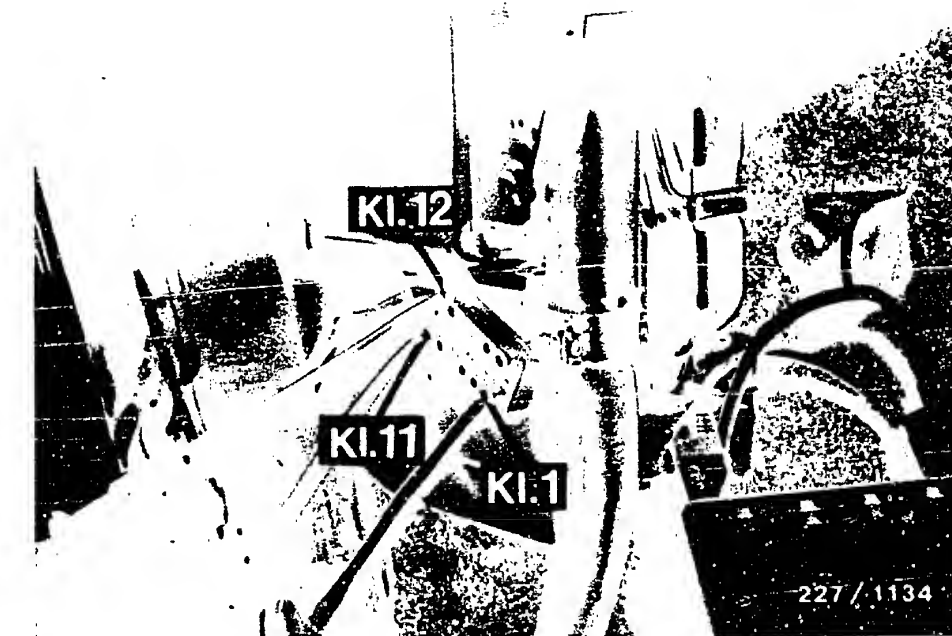
Both control units have a non-volatile memory. Therefore, before a diagnosis, the battery must not be disconnected and the two control-unit plugs must not be disconnected. FAULT MEMORY WILL BE ERASED.

If the fault memory has been erased, perform a road test/test on chassis dynamometer at engine speed greater than 5000 min⁻¹, briefly pressing the accelerator all the way to the floor. Ignition OFF (switch off engine).

Connect voltmeter to diagnostic plug term. 1 (+) and term. 11 (-).
Ignition ON (Engine must not be started throughout the entire self-diagnosis).
Voltmeter indicates battery voltage.

Connect diagnostic plug term. 12 (" stimulus lead ") to vehicle ground for 2.5...5 Seconds (use watch). See picture.
The fault code now indicated is noted down by the test operator (for fault rectification: SIS LH-Jetronic).

Starting with the start signal, the respective fault code is repeated until the "stimulus lead" at the diagnostic plug is actuated again as already described.
The fault memory is read out gradually by activating the "stimulus lead" until the fault code " 1 " (end of fault output) appears with the LH-Jetronic.



Diagnostic plug

HOW TO USE SELF-DIAGNOSIS, SELF-DIAGNOSIS TEST TABLE AND TROUBLE-SHOOTING PROGRAM (continued)

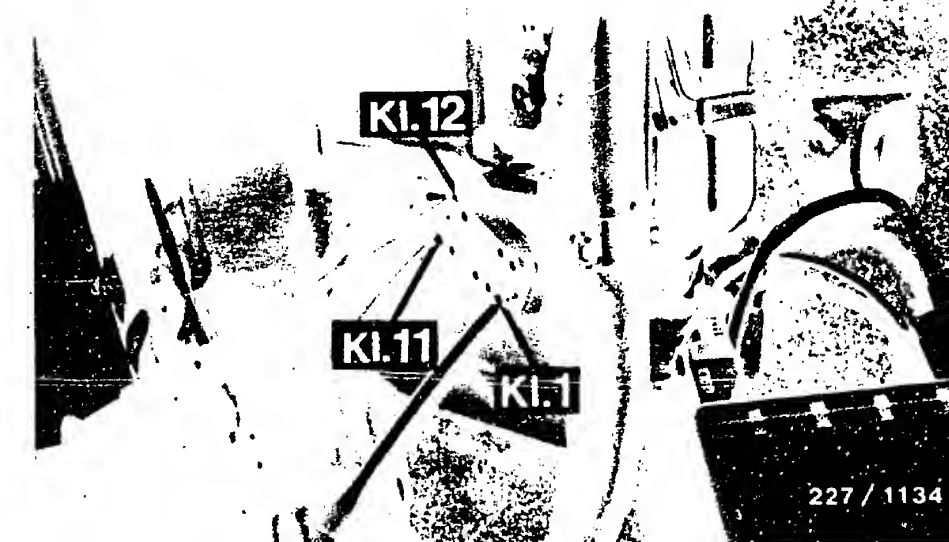
The EI-K control unit is now ready to output the self-diagnosis.
For this purpose, activate "stimulus lead" for 2.5...5 seconds.

The fault code now indicated is noted down by the test operator. The fault memory is read out in steps in that the "stimulus lead" is activated until the fault code "2" (end of fault output) appears for the EI-K.

A new run-through of the diagnosis LH and EI-K can be performed by switching the ignition off and on again prior to activation of the "stimulus lead".

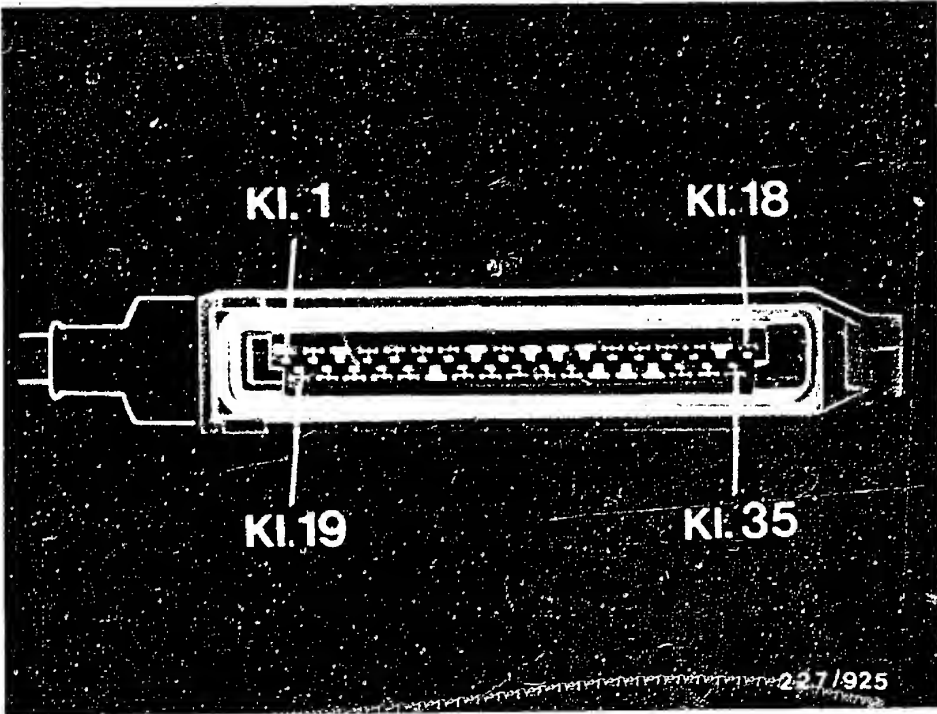
While fault code " 2 " (end of fault output) is indicated, activate "stimulus lead" for longer than 10 seconds (use watch).
FAULT MEMORY WILL NOW BE ERASED.

For fault rectification, start with the fault first indicated.
Then perform a road test with subsequent activation of the self-diagnosis.



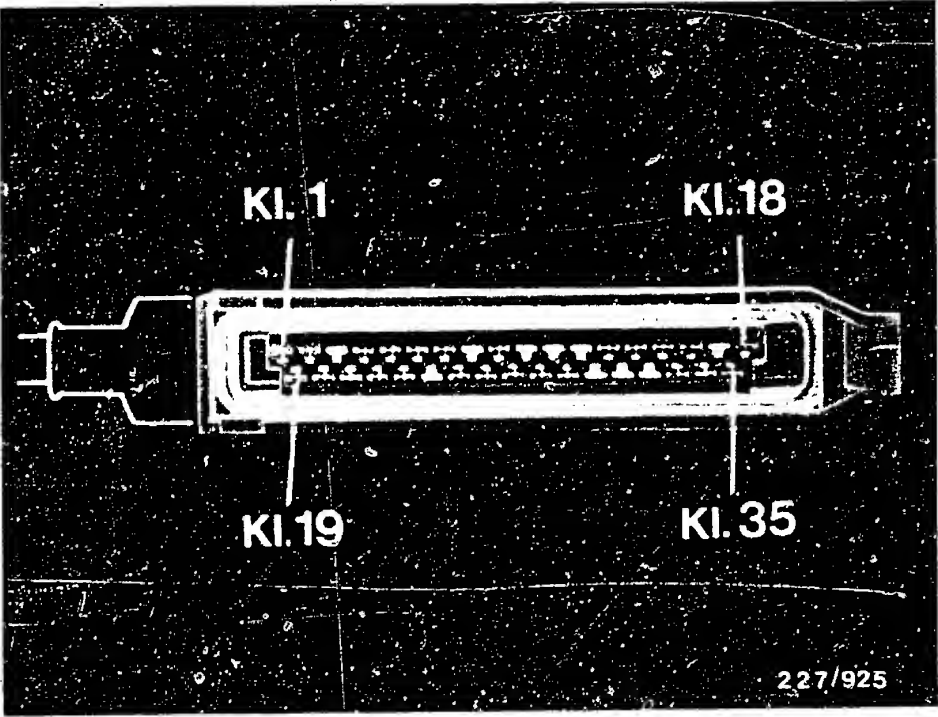
SELF-DIAGNOSIS TEST TABLE

Fault indication Fault code	Testing of component/ function Test instructions/conditions	Term- inals	Set values	Coor- dinate
2	END OF FAULT OUTPUT	—	—	—
25	NO FAULT STORED	—	—	—
2112 / 2212 2115 / 2215	IDLE THROTTLE-VALVE SWITCH Disconnect LH-Jetronic control-unit plug. See picture. Resistance of EI-K control-unit plug. See picture. Throttle valve in idle position. Open throttle valve approx. 1°.	8 18	approx. 0 Ω (continuity) infinity Ω	
2113 / 2213 2115 / 2215	FULL-LOAD THROTTLE-VALVE SWITCH Disconnect LH-Jetronic control-unit plug. See picture. Resistance of EI-K control-unit plug. See picture. Accelerator in full-load position. Release accelerator (idle position)	18 26	approx. 0 Ω (continuity) infinity Ω	
2114 / 2214	COOLANT-TEMPERATURE SENSOR Resistance of EI-K control-unit plug. See picture.	18 19	See brief instructions	

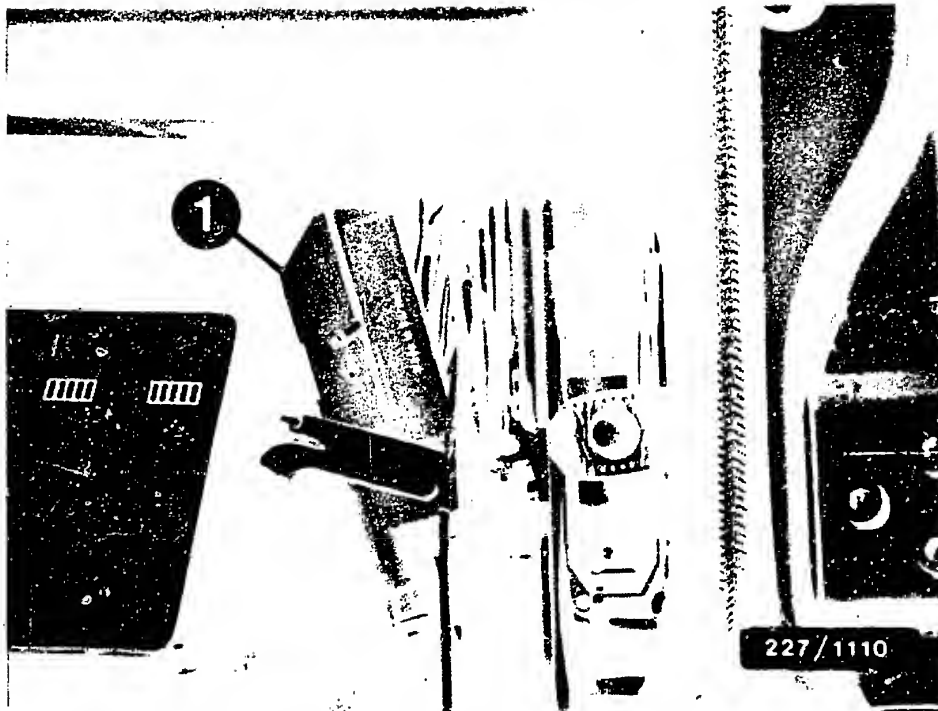


SELF-DIAGNOSIS TEST TABLE (continued)

Fault indication Fault code	Testing of components/ function Test instructions/conditions	Term- inals	Set values	Coor- dinate
2121 / 2221	<p>LOAD SIGNAL</p> <p>Resistance of EI-K and LH-Jetronic control-unit plugs. See top picture. LH-Jetronic control-unit plug.</p> <p>Voltage at EI-K control-unit plug with handle cover removed. See center picture, Item 1 Engine idle <u>Note:</u> ANALOG VOLTMETER (small measuring range).</p> <p>Briefly fully depress accelerator (burst of throttle). Observe voltmeter.</p>	<p>9 25</p> <p>9 18 (+) (-)</p>	<p>approx. 0 Ω (continuity)</p> <p>0.1...1 V</p> <p>Slight increase in voltage</p>	
2126 / 2226	<p>TRANSMISSION OVERLOAD PROTECTION</p> <p>Resistance of overload-protection switch. See bottom picture, arrow. Engine idle. Pull on handbrake. Observe safety regulations (e.g. chocks under rear wheels). Transmission selector lever in position: Driving position "N" or "P"</p> <p>Driving position "D"</p> <p>Ignition OFF. Continued on next picture page</p>	<p>—</p> <p>—</p>	<p>greater than 20 k Ω (open circuit)</p> <p>less than 1 Ω (continuity)</p>	



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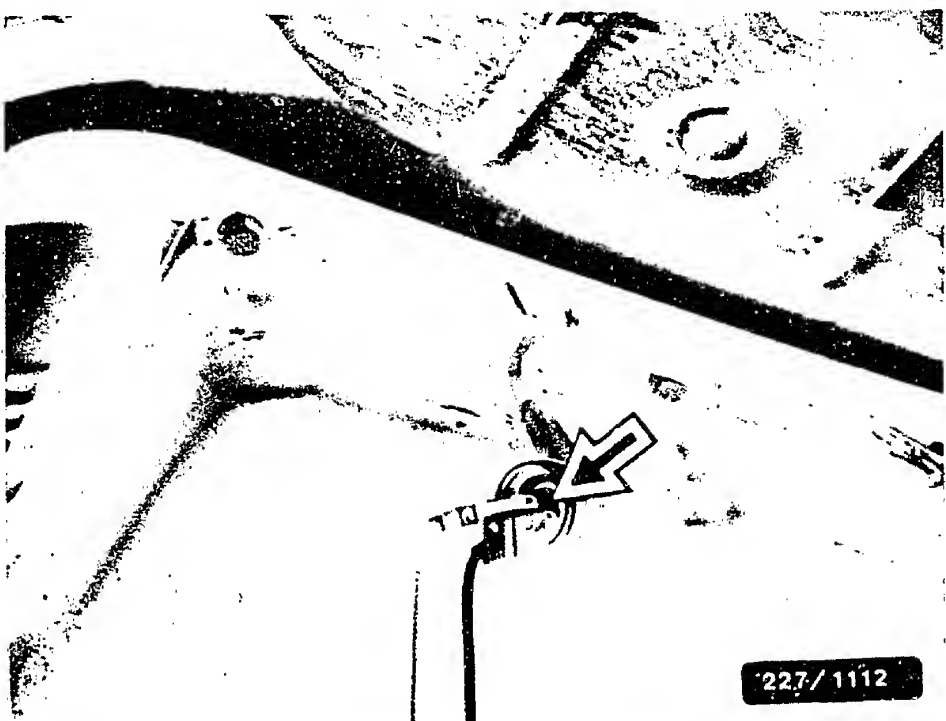
227/1110



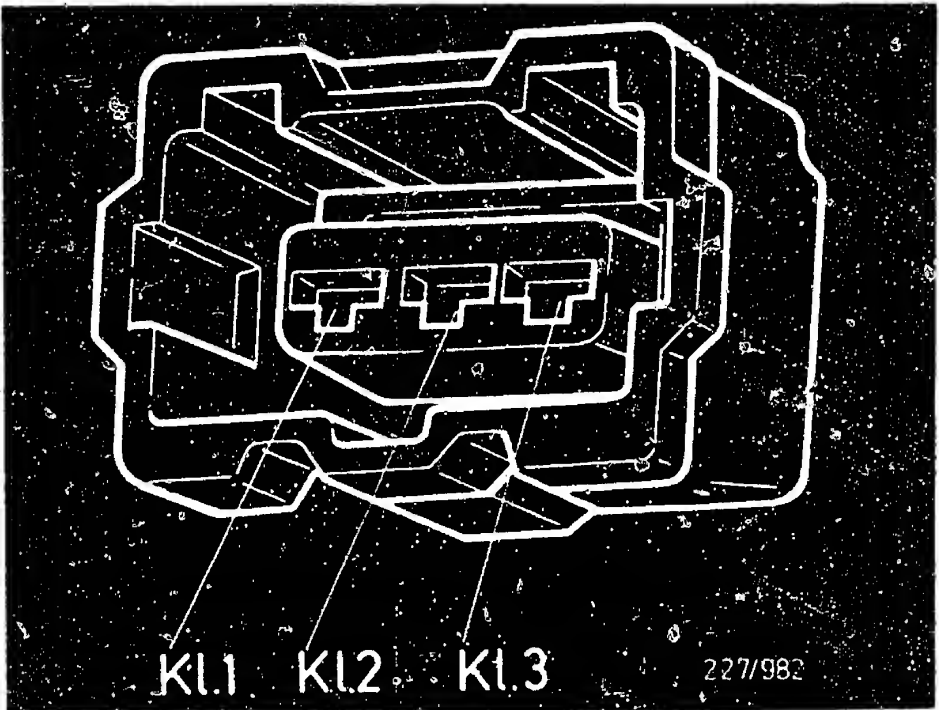
227/1111

SELF-DIAGNOSIS TEST TABLE (continued)

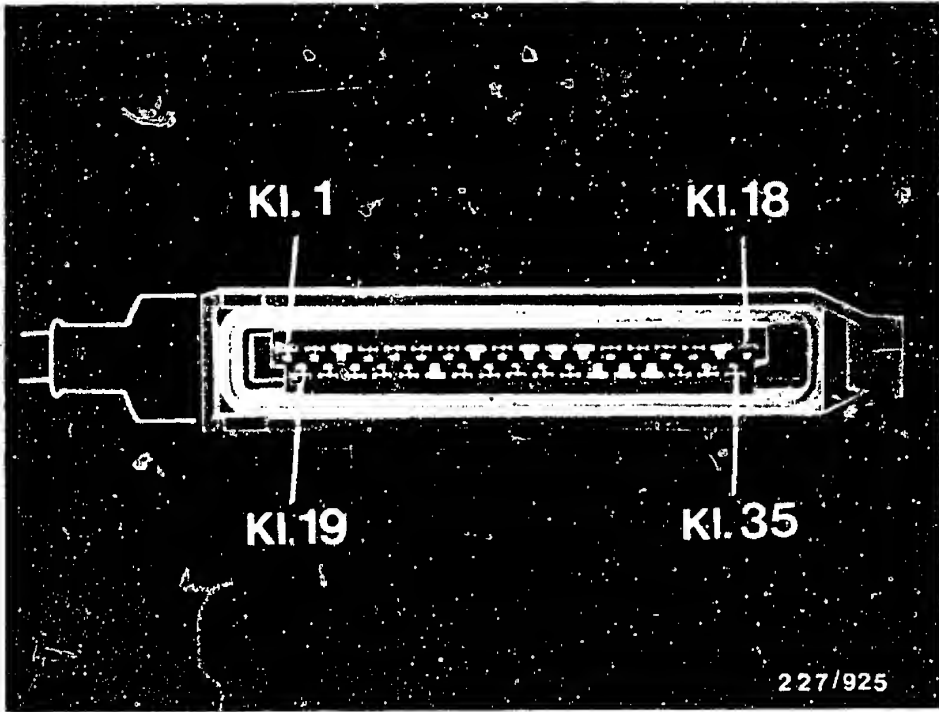
Fault indication Fault code	Testing of components/ function Test instructions/conditions	Term- inals	Set values	Coor- dinate
2126 / 2226	TRANSMISSION OVERLOAD PROTECTION (continued) Voltage at connector of trans. overload protection switch. See top picture, arrow. Ignition ON.	—	approx. 10 V	
2131 / 2231	KNOCK SENSOR CYL. 1 - 2 - 5 - 6 Visual examination of knock-sensor plug connector (oxidation). See center picture. Resistance of knock-sensor plug connector and EI-K control-unit plug. See center and bottom pictures. Resistance of EI-K control-unit plug. See bottom picture. Tightening torque (takes approx. 6 hours).	1 20 2 2 3 2 18 20	approx. 0 Ω approx. 0 Ω approx. 0 Ω infinity Ω see brief instructions	
2132 / 2232	KNOCK SENSOR CYL. 3 - 4 - 7 - 8 Visual examination of knock-sensor plug connector (oxidation). See center picture. Continued on next picture page			



227/1112



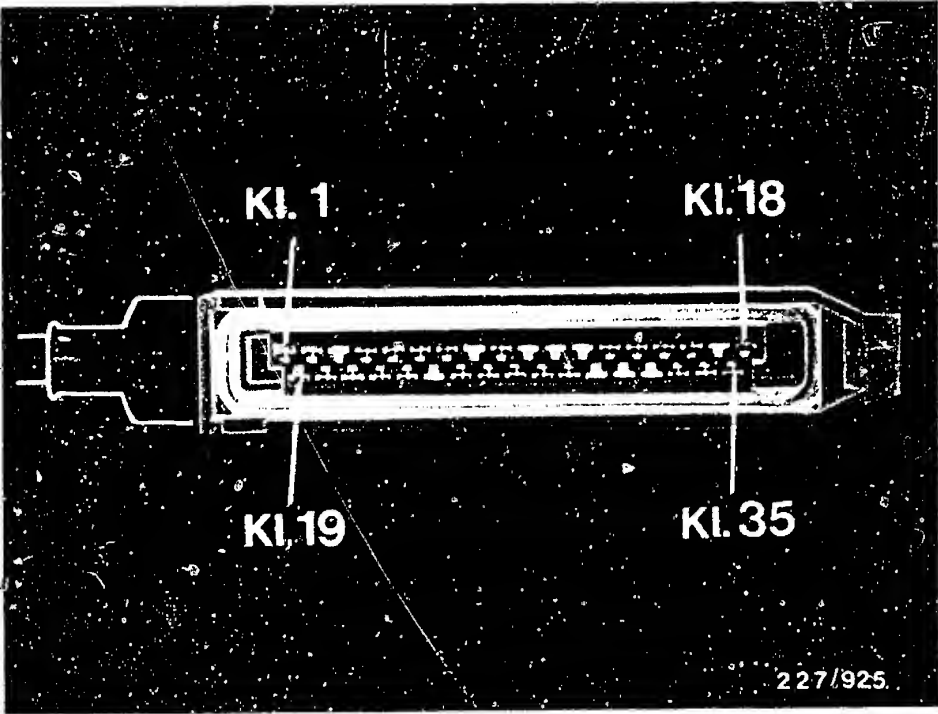
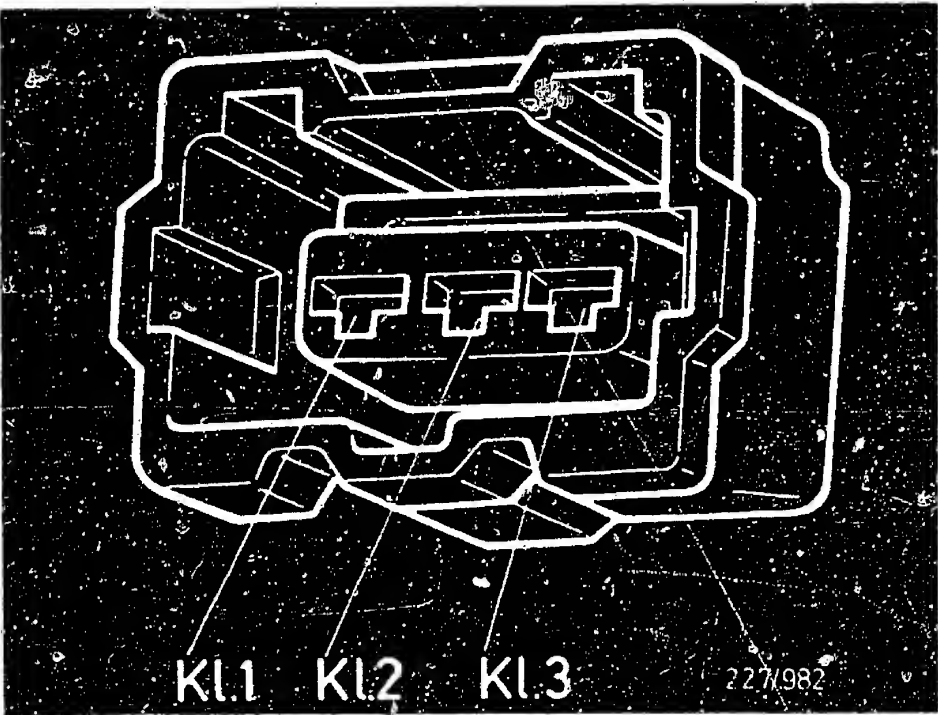
227/982



227/925

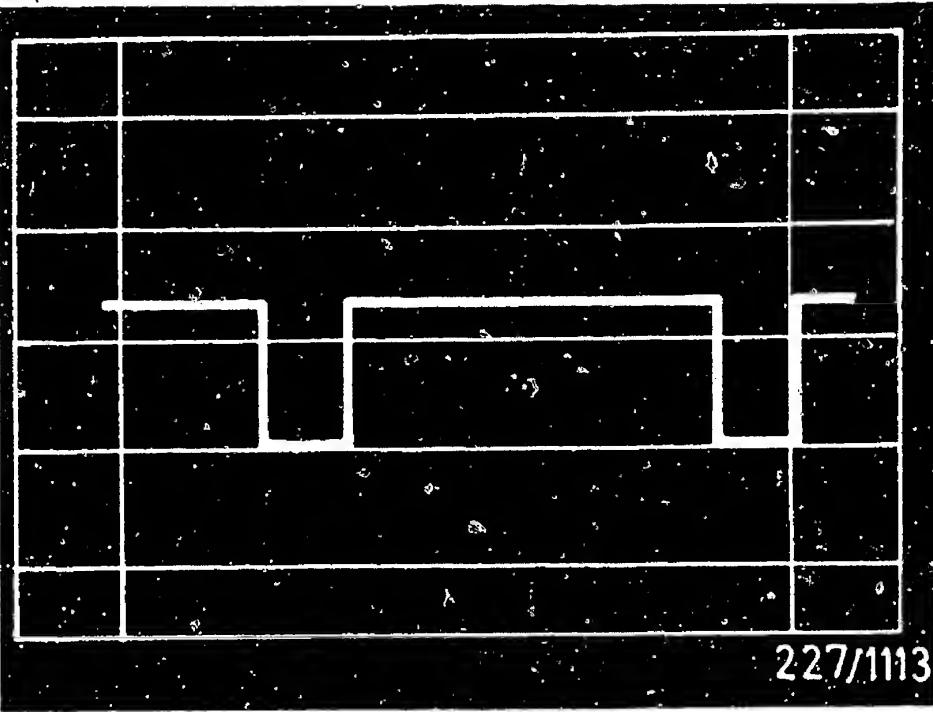
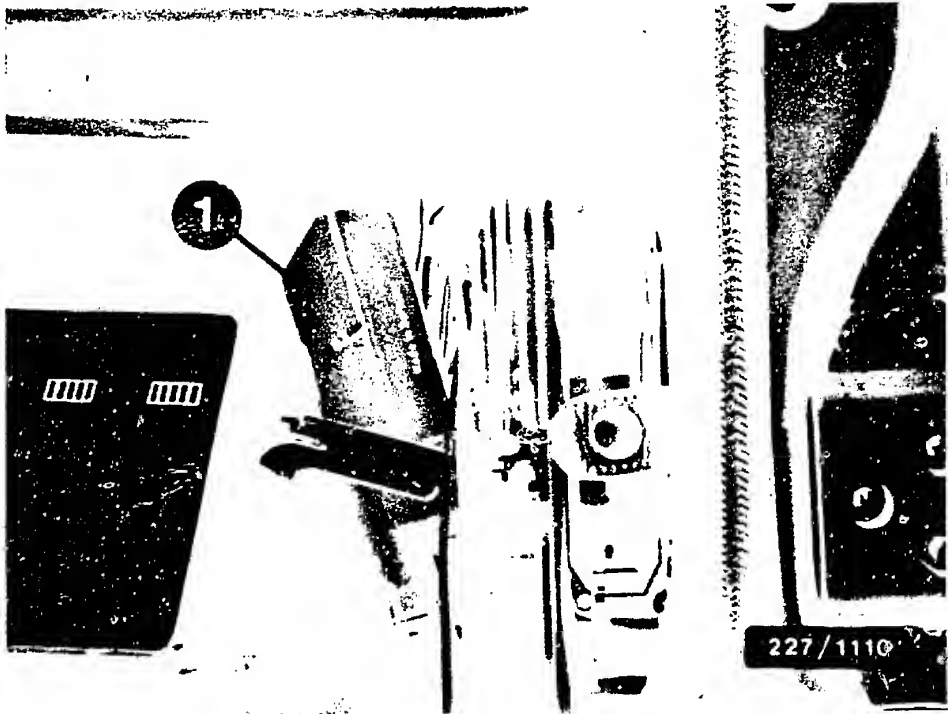
SELF-DIAGNOSIS TEST TABLE (continued)

Fault indication Fault code	Testing of components/ function Test instructions/conditions	Term- inals	Set values	Coor- dinate
2132 / 2232	<p>KNOCK SENSOR CYL. 3 - 4 - 7 - 8 (continued)</p> <p>Resistance of knock-sensor plug connector and EI-K control-unit plug. See top and bottom pictures.</p> <p>Resistance of EI-K control-unit plug. See bottom picture.</p> <p>Tightening torque (takes approx. 6 hours).</p>	<p>1 21 2 3 3 3</p> <p>18 21</p>	<p>approx. 0 Ω approx. 0 Ω approx. 0 Ω</p> <p>infinity Ω</p> <p>See brief instructions</p>	
2133 / 2233	<p>EI-K CONTROL UNIT (evaluation circuit)</p> <p>EI-K control unit defective.</p>	—	—	—



SELF-DIAGNOSIS TEST TABLE (continued)

Fault indication Fault code	Testing of components/ function Test instructions/conditions	Term- inals	Set values	Coor- dinate
2134 / 2234	HALL-GENERATOR CYLINDER RECOGNITION Rectangular pulse at EI-K control- unit plug with handle cover removed. See top picture, Item 1. Start engine.	22 B- (+) (-)	Rectangular pulse (see bottom picture)	
2141 / 2241	EI-K CONTROL UNIT EI-K control unit defective.	—	—	—



SELF-DIAGNOSIS TROUBLE-SHOOTING PROGRAM (1)

Fault code

21 12 / 22 12
21 15 / 22 15

N>

Check idle throttle-
valve switch.

Disconnect LH-Jetronic control-
unit plug.
See top picture.

Disconnect EI-K control-unit
plug and connect ohmmeter
to term.8 and term.18.
See top picture.

Throttle valve is in
idle position.

Set value: approx. 0 Ω
(continuity)

Open throttle valve approx. 1°.

Set value: infinity Ω

Set value obtained?

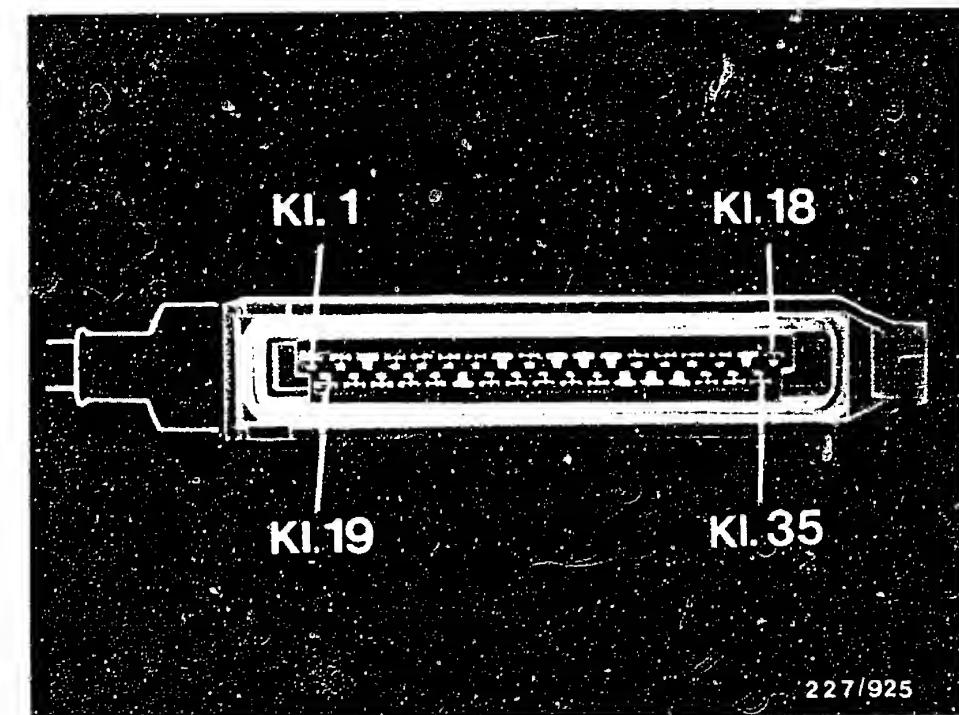
1. Remove intake-air
distributor and intake manifold
(takes approx.
6 hours).

Disconnect throttle-valve
switch plug and check for open
circuit in lead from term.8
(bottom picture) to EI-K control-unit
plug term.8.

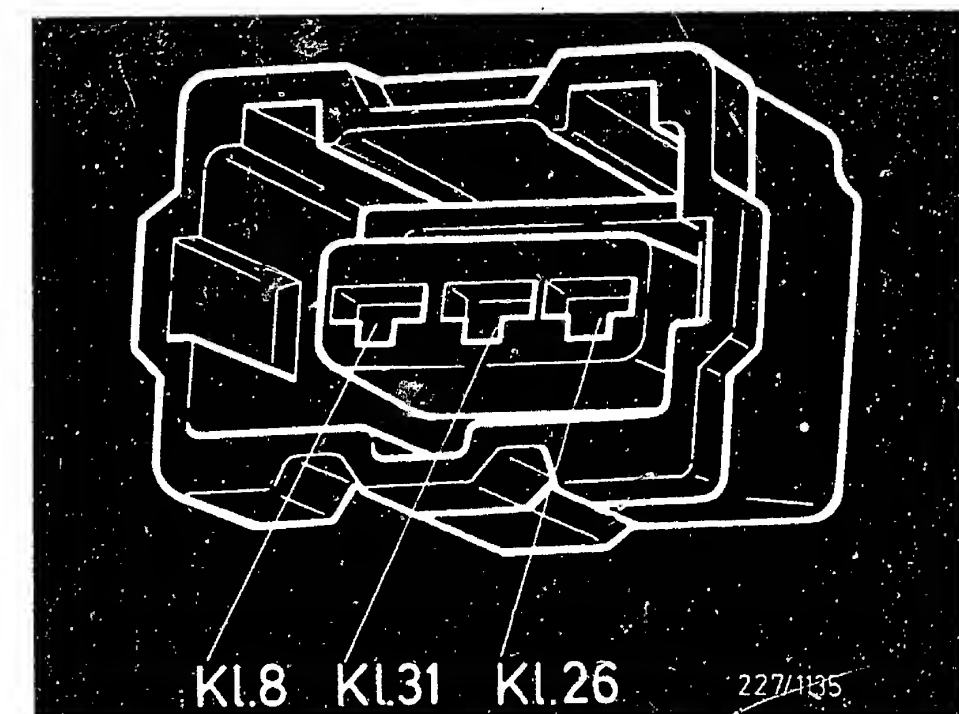
Eliminate open circuit.

Check for open circuit in
lead from throttle-valve switch
plug term.31 (bottom picture)
to engine-electronics ground
(on top part of crankcase at
rear right).

Eliminate open circuit.



LH-Jetronic or EI-K control-
unit plug



Throttle-valve switch plug

Return to self-diagnosis
test table B19

Continued on next picture page



2. Connect ohmmeter to
throttle-valve switch term. 2
and term. 18.

Throttle valve closed.

Set value: approx. 0 Ω
(continuity)

Open throttle valve approx. 1°.
Set value: infinity Ω

If set value not obtained,
adjust throttle-valve
switch.

P r o c e d u r e :
Loosen fastening screws of throttle-
valve switch somewhat and turn
throttle-valve switch until idle
contact switches.

Set value: approx. 0 Ω
(continuity)

If set value not obtained,
replace throttle-valve
switch.

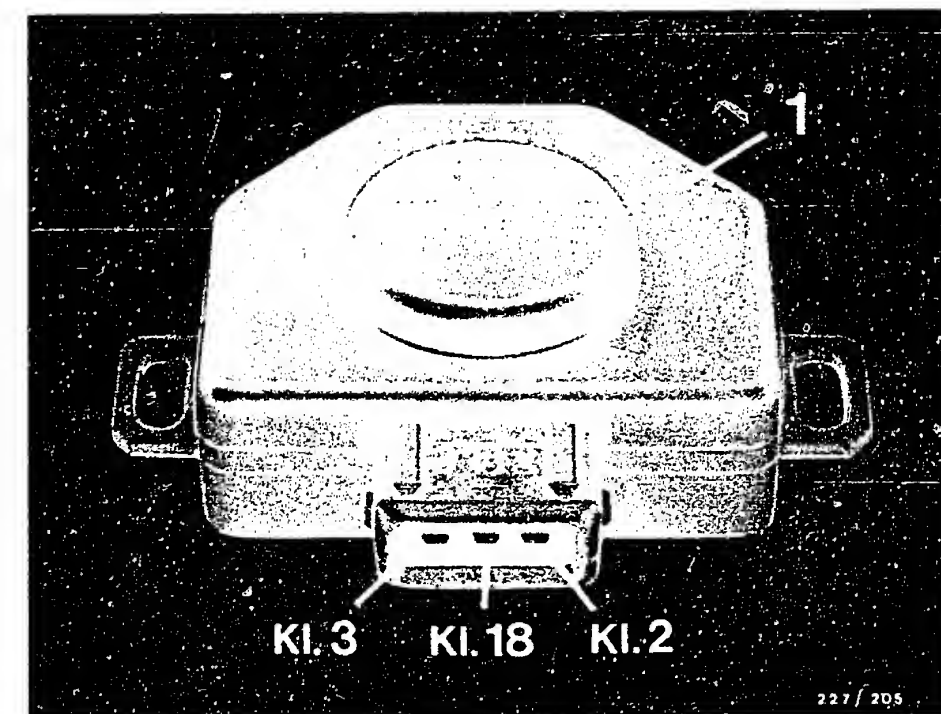
Tighten fastening screws
of throttle-valve switch.

C h e c k :
Open throttle valve approx. 1° .

Set value: infinity Ω



Return to self-diagnosis
test table B19



Throttle-valve switch

SELF-DIAGNOSIS TROUBLE-SHOOTING PROGRAM (2)

Fault code

21 13 / 22 13

21 15 / 22 15

N>

Check full-load throttle-valve switch.

Disconnect LH-Jetronic control-unit plug,
See top picture.

Disconnect EI-K control-unit
plug and connect ohmmeter
to term.26 and term.18 .
See top picture.

Accelerator in full-load position..

Set value: approx. 0 Ω
(continuity)

Release accelerator (idle
position).

Set value: infinity Ω

Set value obtained?

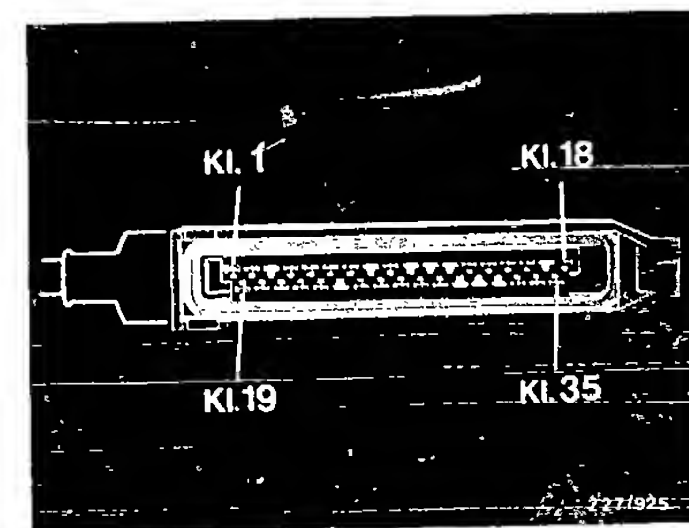
1. Remove intake-air
distributor and intake manifold
(takes approx.
6 hours).

Disconnect throttle-valve
switch plug and check for open
circuit in lead from term.26
(bottom picture) to EI-K control-unit
plug term.26.

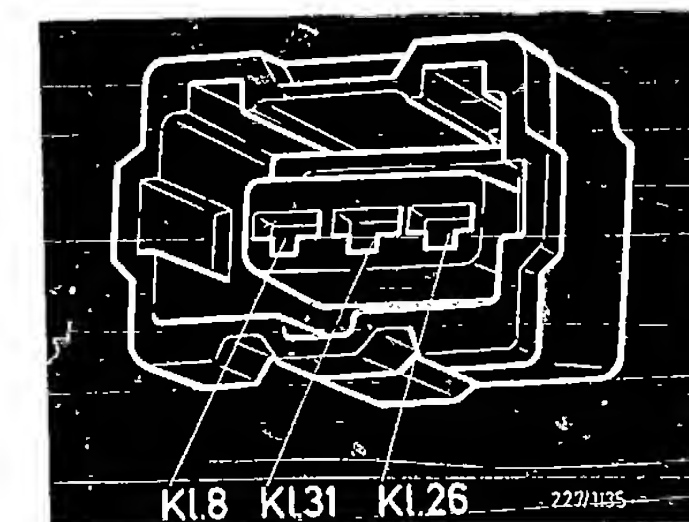
Eliminate open circuit.

Check for open circuit in
lead from throttle-valve switch
plug term.31 (bottom picture)
to engine-electronics ground
(on top part of crankcase at
rear right).

Eliminate open circuit.



LH-Jetronic or EI-K control-unit plug



Throttle-valve switch plug

Return to self-diagnosis
test table B19

Continued on next picture page

2. Connect ohmmeter to
throttle-valve switch
term. 3 and term. 18.

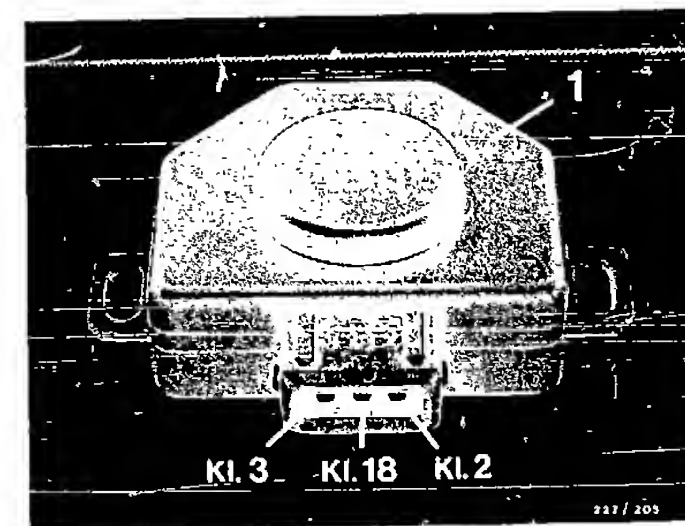
Accelerator in full-load ,
position.

Set value: approx. 0 Ω
(continuity)

Release accelerator
(idle position)

Set value: infinity Ω

If set value not obtained,
replace throttle-valve
switch.



Throttle-valve switch

Return to self-diagnosis
test table B19

SELF-DIAGNOSIS TROUBLE-SHOOTING PROGRAM (3)

Fault code
21 14 / 22 14

N>

Check coolant-temperature
sensor.

Disconnect EI-K control-unit
plug and connect ohmmeter to
term.19 and term.18.
See top picture.

Set value: see brief instructions

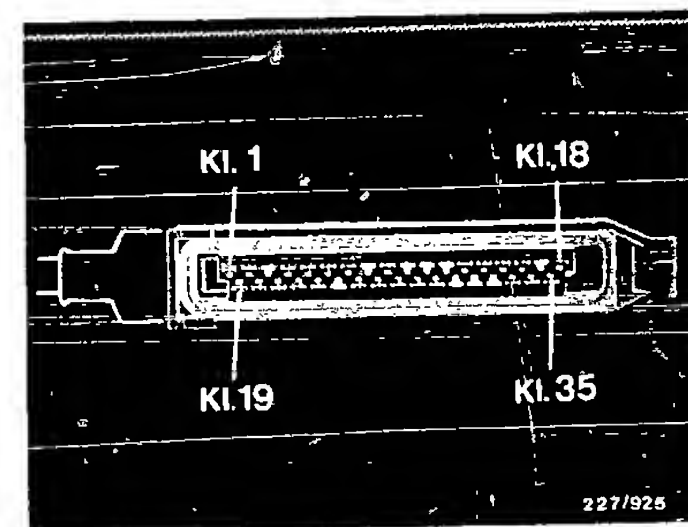
Set value obtained?

Disconnect temperature-
sensor plug. See bottom picture.

Check for open circuit in
lead from EI-K control-unit
plug term.19 to temperature-
sensor plug term.19.

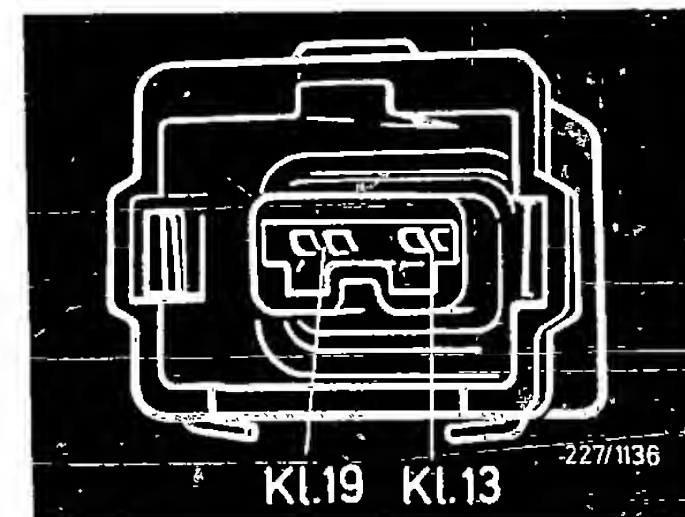
Eliminate open circuit.

If there was no open circuit,
replace coolant-temperature
sensor.



EI-K control-unit plug

Coolant-temperature sensor
plug



Return to self-diagnosis
test table B19

SELF-DIAGNOSIS TROUBLE-SHOOTING PROGRAM (4)

Fault code
21 21 / 22 21

N>

Eliminate open circuit.

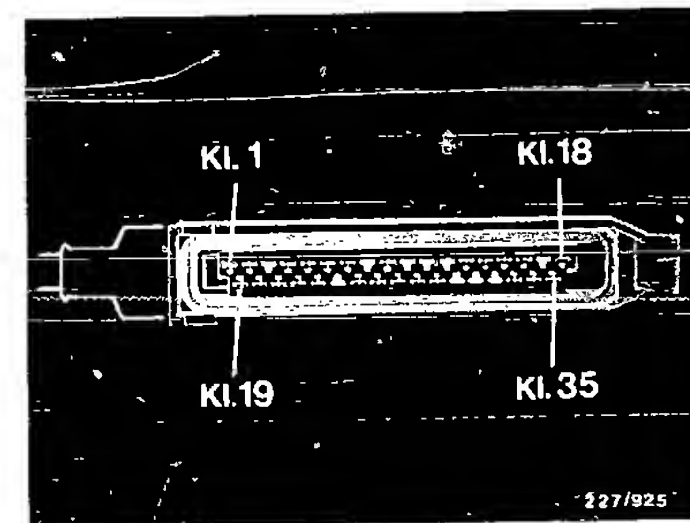
Check load signal.

Disconnect EI-K- and
LH-Jetronic control-unit plugs.

Connect ohmmeter to EI-K
control-unit plug term.9 and
LH-Jetronic control-unit
plug term.25.
See picture.

Set value: approx. 0 Ω
(continuity)

Set value obtained?



LH-Jetronic or EI-K control-
unit plug

Continued on next picture page

SELF-DIAGNOSIS TROUBLE-SHOOTING PROGRAM (4) CONTINUED (1)

Connect LH-Jetronic control-unit plug.

N>

After unscrewing fastening screws and taking off rubber gasket, push back handle cover on EI-K control-unit plug.
See picture.

Connect EI-K control-unit plug and connect ANALOG VOLTMETER to term. 9 (+) and term.18 (-).

Note:
Select small measuring range.

Operate engine at idle.

Set value: 0,1...1 V

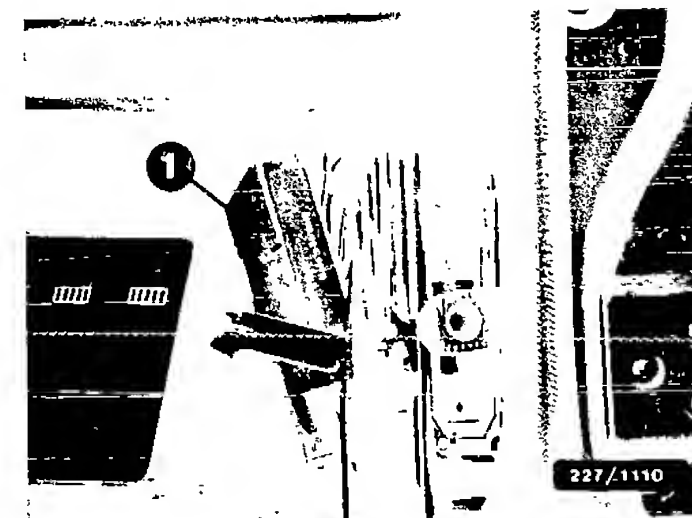
B r i e f l y fully depress accelerator (burst of throttle).
Observe voltmeter.

Set value: Slight increase
in voltage.

Set value obtained?

Test LH-Jetronic according to SIS.

If LH-Jetronic was O.K.,
try replacing EI-K or LH-Jetronic control unit.



1 = Handle cover

Replace EI-K control unit.

Return to self-diagnosis
test table B21

SELF-DIAGNOSIS TROUBLE-SHOOTING PROGRAM (5)

Fault code
21 26 / 22 26

N>

Check transmission overload protection.

Loosen union nut on transmission overload-protection switch and disconnect connector.
See picture, arrow.

Connect ohmmeter to transmission overload-protection switch
See picture, arrow.

Operate engine at idle.

Pull on handbrake.

C a u t i o n :
For the following test, observe safety regulations (e.g. chocks under rear wheels).

See table for set values for transmission selector-lever positions:

Driving position	Resistance value
"N" or "P" = > 20	k Ω (open circuit)
"D" = < 1	Ω (continuity)

Set value obtained?

Replace transmission overload-protection switch.

Repeat test.

If set value still not obtained, repair transmission.
(Porsche agent).



Continued on next picture page

SELF-DIAGNOSIS TROUBLE-SHOOTING PROGRAM (5) CONTINUED (1)

Switch off ignition.

EI-K control-unit plug
connected.

Connect voltmeter to disconnected
connector of transmission
overload-protection switch.
See picture, arrow.

Switch on ignition.

Set value: approx. 10 V

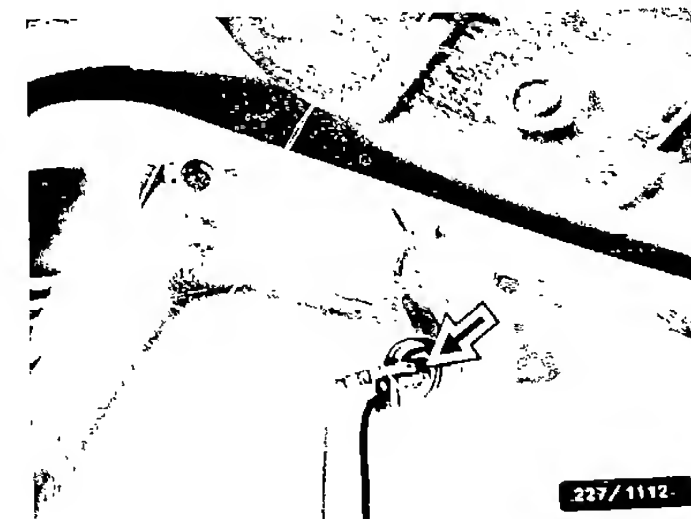
Set value obtained?

N>

Check connection for open circuit
on positive and negative sides.

Eliminate open circuit.

If there was no open circuit,
replace EI-K control unit.



Return to self-diagnosis
test table B23

SELF-DIAGNOSIS TROUBLE-SHOOTING PROGRAM (6) CONTINUED (1)

Disconnect EI-K control-unit plug.
See top picture.

Connect ohmmeter to :

Knock-sensor plug connector	EI-K control- unit plug
Term. 1	Term. 20
Term. 2	Term. 2
Term. 3	Term. 2

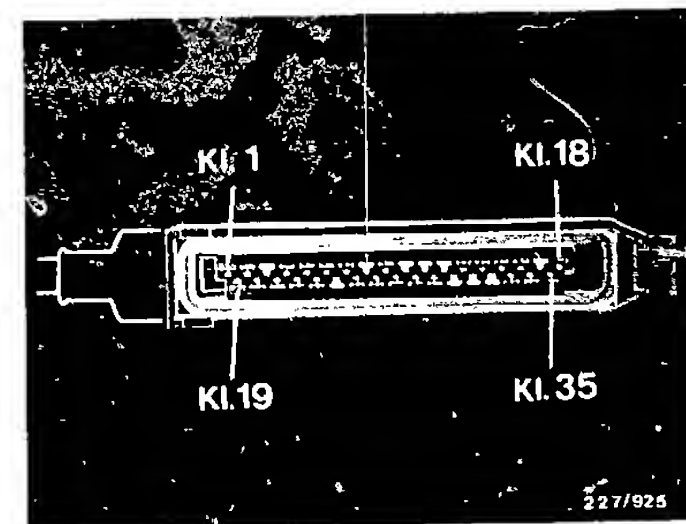
Term. 1	Term. 20
Term. 2	Term. 2
Term. 3	Term. 2

Set value: approx. 0 Ω
(continuity)

Set value obtained?

N>

Eliminate open circuit.



EI-K control-unit plug

Connect ohmmeter to EI-K control-unit plug term. 18 and term. 20.

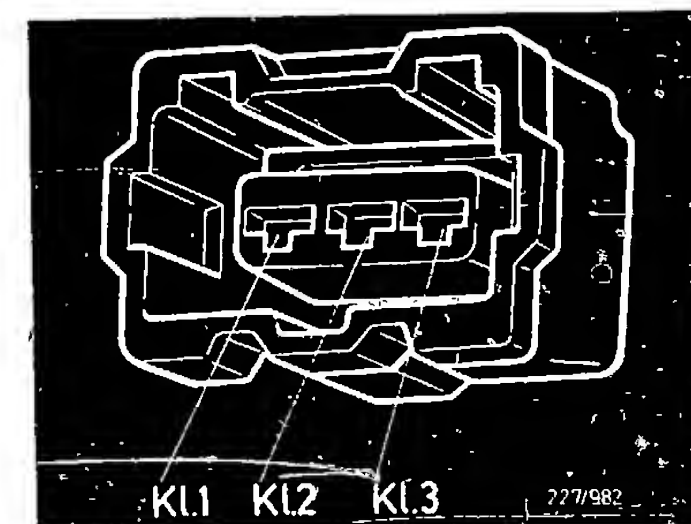
Set value: infinity Ω
(open circuit)

Set value obtained?

N>

If ohmmeter indicates approx. 0 Ω (continuity), eliminate short circuit to ground in EI-K control-unit plug to knock-sensor plug connection.

Knock-sensor plug connector



Continued on next picture page

SELF-DIAGNOSIS TROUBLE-SHOOTING PROGRAM (6) CONTINUED (2)

Remove intake-air distributor
and intake manifold (takes
approx. 6 hours).

Replace knock sensor.

Observe tightening torque.

Set value: see brief instructions

Activate self-diagnosis.

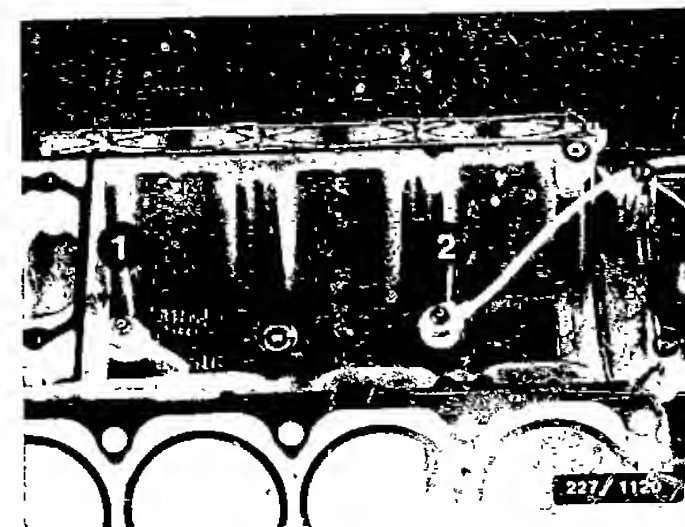
"Old" knock sensor is
defective if fault code
21 31 / 22 31
is no longer indicated.

Self-diagnosis O.K.?

N>

Replace EI-K control unit.

Do not re-install "old"
knock sensor.



1 = Knock sensor
Cylinders 1 - 2 - 5 - 6

Return to self-diagnosis
test table B23

SELF-DIAGNOSIS TROUBLE-SHOOTING PROGRAM (7)



Fault code

21 32 / 22 32

Check knock sensor (cylinders 3 - 4
- 7 - 8).

VISUAL EXAMINATION

Take apart knock-sensor plug
connector.
See picture, arrow.

Check contacts of plug connector
for oxidation.

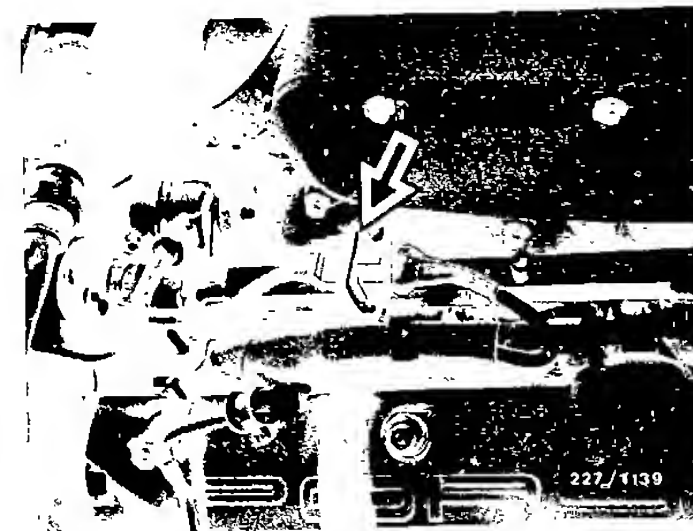
Visual examination O.K.?

N>

Eliminate oxidation.



Continued on next picture page



SELF-DIAGNOSIS TROUBLE-SHOOTING PROGRAM (7) CONTINUED (1)

Disconnect EI-K control-unit plug.
See top picture.

Connect ohmmeter to :

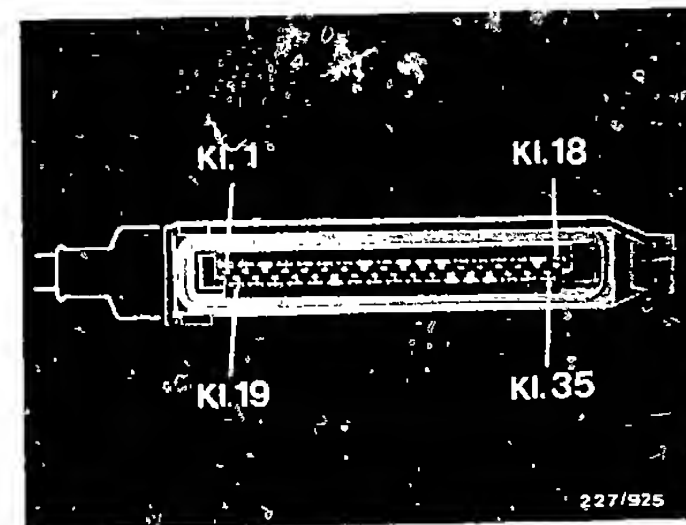
Knock-sensor plug connector	EI-K control- unit plug
Term. 1	Term. 21
Term. 2	Term. 3
Term. 3	Term. 3

Set value: approx. 0 Ω
(continuity)

Set value obtained?

N>

Eliminate open circuit.



EI-K control-unit plug

Connect ohmmeter to EI-K control-unit plug term. 18 and term. 21.

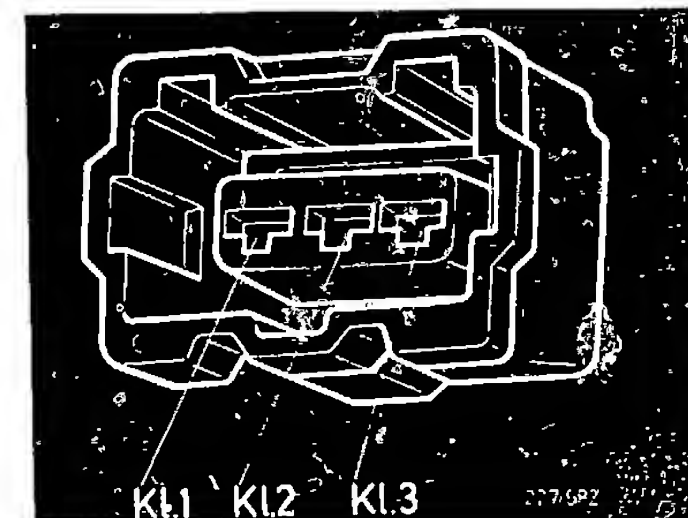
Set value: infinity Ω
(open circuit)

Set value obtained?

N>

If ohmmeter indicates approx. 0 Ω (continuity), eliminate short circuit to ground in EI-K control-unit plug to knock-sensor plug connection.

Knock-sensor plug connector



Continued on next picture page

SELF-DIAGNOSIS TROUBLE-SHOOTING PROGRAM (6)

V

Fault code

21 31 / 22 31

N>

Eliminate oxidation.

Check knock sensor (cylinders 1 - 2 -
5 - 6).

VISUAL EXAMINATION

Take apart knock-sensor plug
connector.

See picture, arrow.

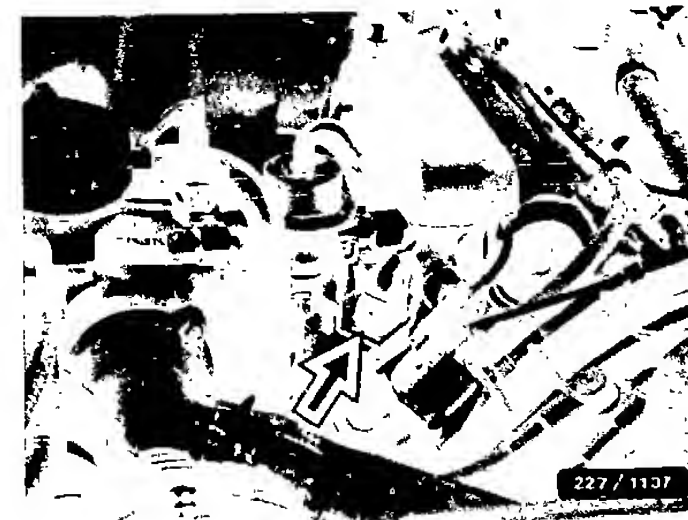
Check contacts of plug connector
for oxidation.

Visual examination O.K.?

Y

V

Continued on next picture page



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SELF-DIAGNOSIS TROUBLE-SHOOTING PROGRAM (7) CONTINUED (2)

V
Remove intake-air distributor
and intake manifold (takes
approx. 6 hours).

Replace knock sensor.

Observe tightening torque.

Set value: see brief instructions

Activate self-diagnosis.

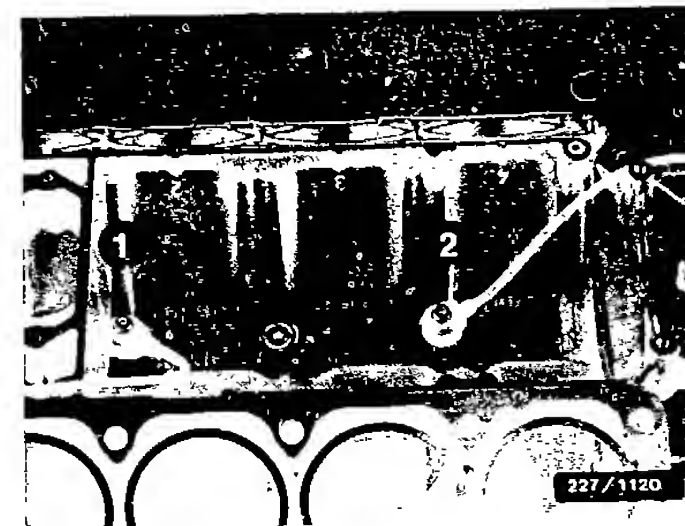
"Old" knock sensor is
defective if fault code
21 32 / 22 32
is no longer indicated.

Self-diagnosis O.K.?

N>

Replace EI-K control unit.

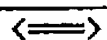
Do not re-install "old"
knock sensor.



2 = Knock sensor
Cylinders 3 - 4 - 7 - 8

V
Return to self-diagnosis
test table B23

D01



D02



SELF-DIAGNOSIS TROUBLE-SHOOTING PROGRAM (8)

Fault code
21 34 / 22 34

N>

Check Hall generator cylinder recognition.

Disconnect EI-K control-unit plug and, after unscrewing fastening screws and taking off rubber gasket, push back handle cover.

Connect EI-K control-unit plug.
See top picture.

Connect oscilloscope according to operating instructions with program switch in "special" position.

For example MOT 201:

Red clamp to EI-K control-unit plug term. 22 (measured signal).

Black clamp to vehicle ground.

Start engine.

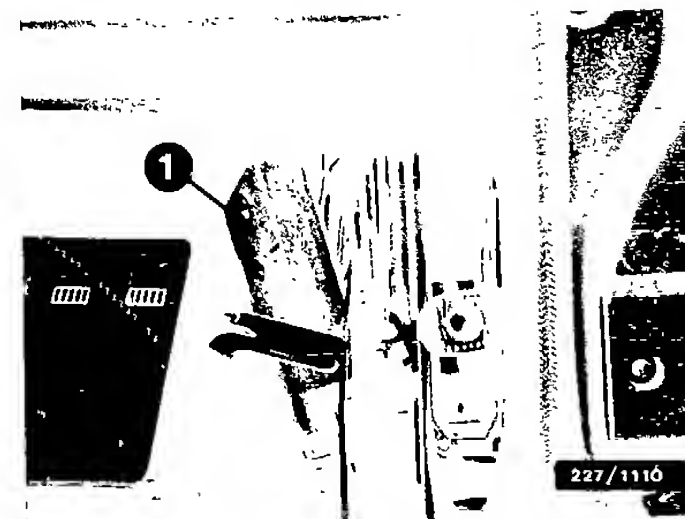
Oscilloscope must indicate rectangular pulse.
See bottom picture.

Rectangular pulse present?

1. Connect voltmeter to connected EI-K control-unit plug term. 5 (+) and term. 4 (-).

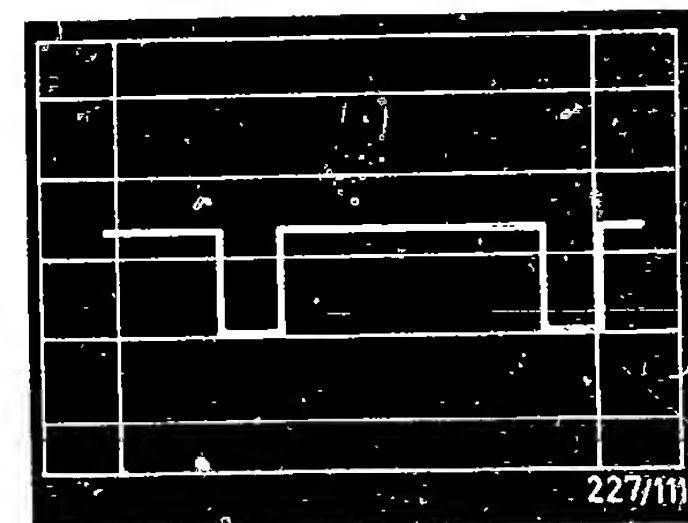
Switch on ignition.

Set value:
equal to /greater than 10 V



1 = Handle cover

Rectangular pulse



Return to self-diagnosis
test table B27

Continued on next picture page

2. If set value not obtained, take apart Hall generator plug connector (top picture, arrow) and connect voltmeter to connected EI-K control-unit plug term. 5 (+) and term. 4 (-).

Switch on ignition.
If set value equal to/
greater than 10 V is not
obtained, replace EI-K
control unit.

If set value equal to/
greater than 10 V is
obtained, replace Hall generator.

3. Disconnect EI-K control-unit plug.
Connect ohmmeter to:

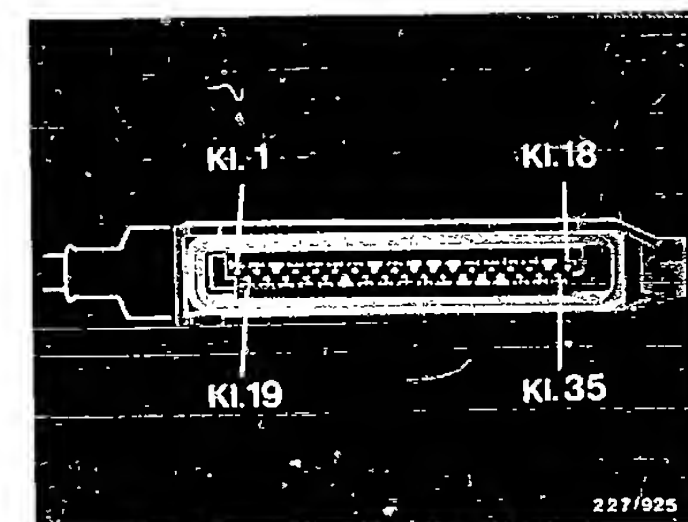
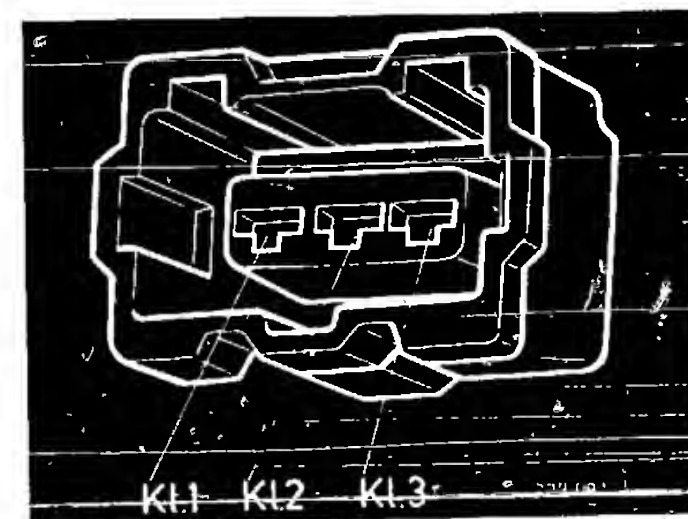
Hall gene-	EI-K control-
rator plug	unit plug
connector	
(center pic.)	(bottom pic.)

Term. 1	and Term. 5
Term. 2	and Term. 22
Term. 3	and Term. 4

Set value: Approx. 0 Ω in each case
(continuity)

If there was no open circuit,
replace Hall generator.

Return to self-diagnosis
test table B27



TROUBLE-SHOOTING PROGRAM (1)

↓

Test high-voltage side.

Test spark plugs, spark-plug connectors, suppression resistors, H.T. ignition cables, distributor cap, distributor rotor etc. for proper operation (e.g. open circuit, shunt).

Assessment e.g. through ignition oscillogram, resistance measurements and visual check.

High-voltage side O.K.?

N>

Repair high-voltage side.

↓

Return to trouble-shooting chart
B04

↓

TROUBLE-SHOOTING PROGRAM (2)

Check ignition coil.

The following tests must be performed on both ignition coils.

Visual examination:

Remove protective cap from ignition coil and check whether plug is in position and/or no sealing compound has escaped.
See picture.

Electrical test:

Ignition coil primary term. 15 and term. 1.

(Take resistance of test lead and test prods into account.)

Set value: see brief instructions

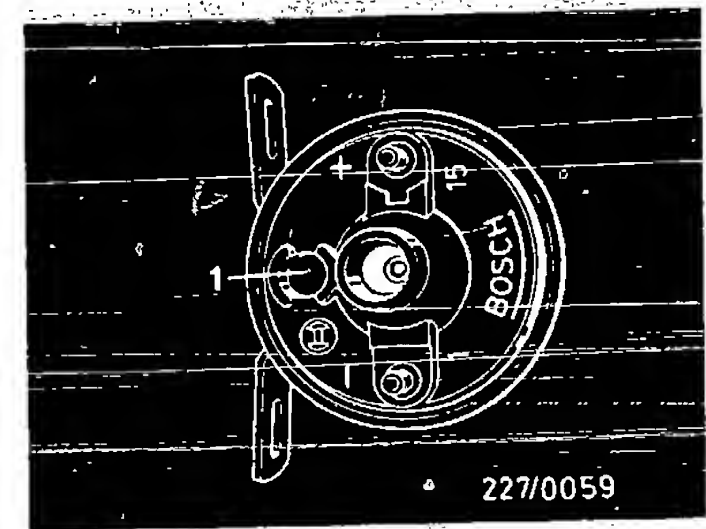
Ignition coil secondary term. 1 and term. 4.

Set value: see brief instructions

Visual examination O.K.
or set value obtained?

N>

1. If plug is not in position and/or sealing compound has escaped, replace ignition coil and EI-K control unit.



1 = Plug

Return to trouble-shooting chart B04

Continued on next picture page

2. Disconnect lead term. 1 of defective ignition coil (plug not in position, sealing compound escaped).

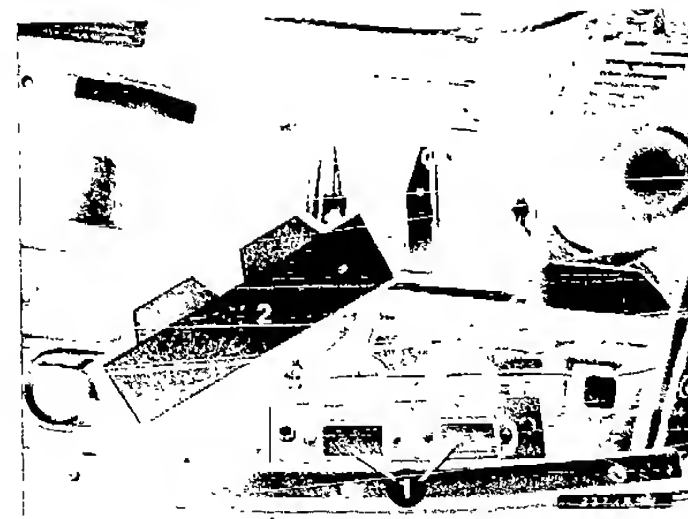
Disconnect both trigger-box plugs.

Connect ohmmeter to disconnected lead from ignition coil term. 1 and, consecutively, to both trigger-box plugs term. 1.

On the trigger-box plug on which the ohmmeter has indicated approx. 0 Ω (continuity), the associated trigger box must be replaced.

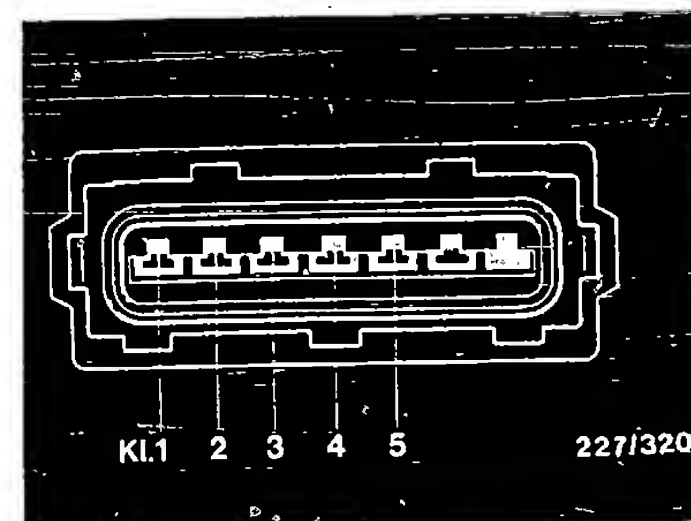
3. If resistance values not O.K., replace ignition coil.

Return to trouble-shooting chart B04



1 = Trigger boxes
2 = Cover

Trigger-box plug



TROUBLE-SHOOTING PROGRAM (3)

Check voltage at trigger boxes.

The following test must be performed on both trigger-box plugs.

Disconnect trigger-box plug and connect voltmeter to term. 4 (+) and term. 2 (-).

Switch on ignition.

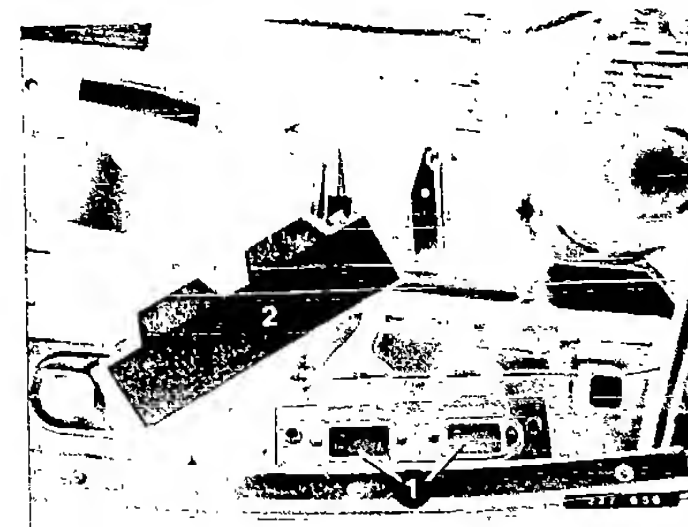
Set value: Battery voltage

Set value obtained?

N>

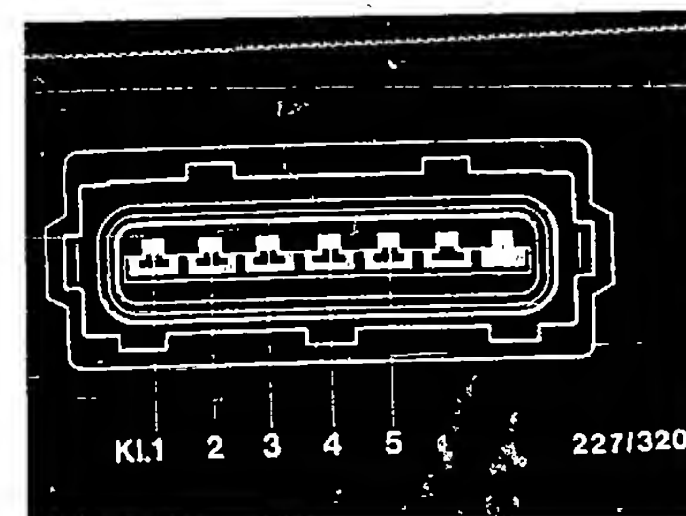
Check for open circuit in leads and connections from ignition/starting switch to trigger-box plug term. 4 including ground lead term. 2.

Eliminate open circuit.



1 = Trigger boxes
2 = Cover

Trigger-box plug



Return to trouble-shooting chart
B04

TROUBLE-SHOOTING PROGRAM (4)

Check voltage of primary circuits.

The following test must be performed on both trigger-box plugs.

Disconnect trigger-box plug and connect voltmeter to term. 1 (+) and term. 2 (-)

Switch on ignition.

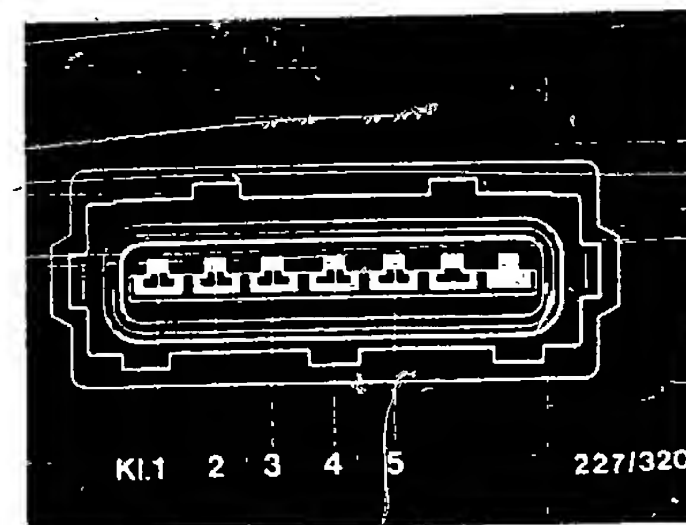
Set value: Battery voltage

Set value obtained?

N>

Check for open circuit in lead from ignition/starting switch to ignition coil term. 15, in primary winding of ignition coil and in lead from ignition coil term. 1 to trigger-box plug term. 1 including ground lead term. 2.

Eliminate open circuit.



Trigger-box plug

Return to trouble-shooting chart
B04

TROUBLE-SHOOTING PROGRAM (5)

Check voltage at EI-K control unit.

N>

Disconnect EI-K control-unit plug and connect voltmeter to term. 29 (+) and term. 18 (-)
See top picture.

Switch on ignition.

Set value: Battery voltage

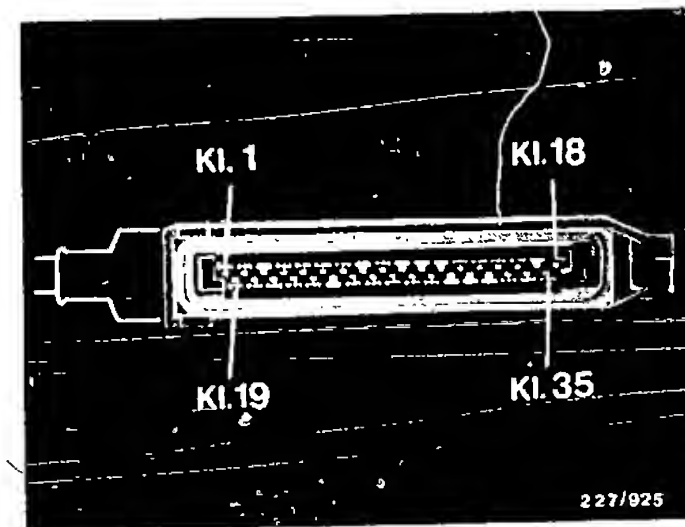
Set value obtained?

1. Switch off ignition.

Connect ohmmeter to EI-K control-unit plug term. 18 and electronics ground point (on top part of crankcase at rear right).
See bottom picture, arrow.

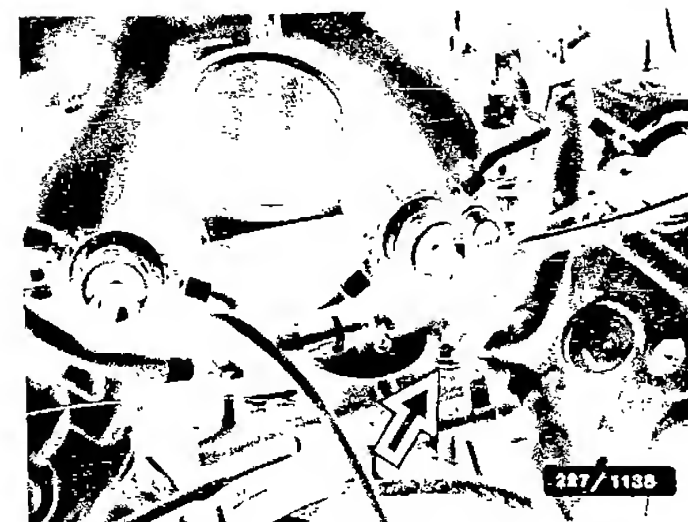
Set value: approx. 0 Ω
(continuity)

Eliminate open circuit.



EI-K control-unit plug

Arrow on right =
Electronics ground point



Return to trouble-shooting chart B04

Continued on next picture page

2. Disconnect ignition power-supply relay.
See top picture, arrow.
Connect voltmeter to connection base term. 86 (+) and vehicle ground.
Switch on ignition.
Set value: battery voltage
If battery voltage not present, check whether jumper is present on 8-pin plug connector, between sockets 1 and 4.
See bottom picture, Item 1.

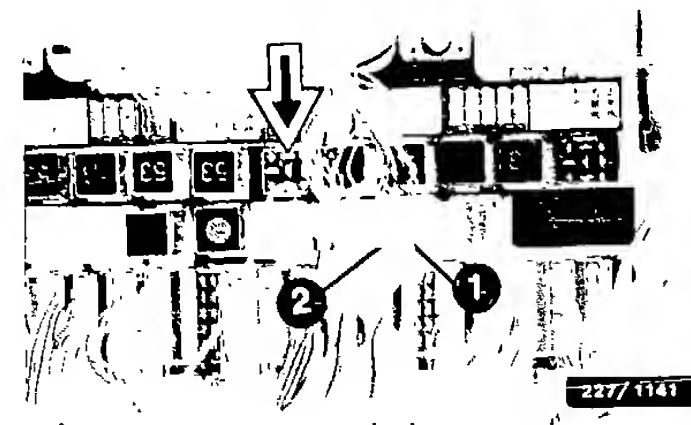
N o t e :

In vehicles without alarm system, jumper is fitted as standard.

In vehicles with alarm system, take apart 8-pin plug connector and jump socket 1 (yellow lead) and socket 4 (red/black lead) with auxiliary cable.

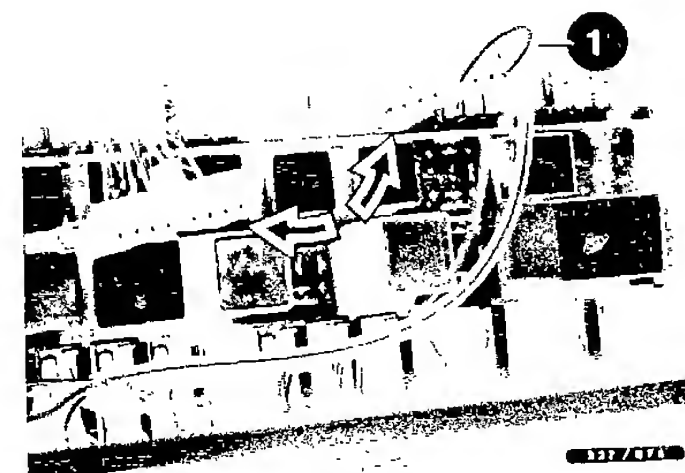
See top picture Item 1 + 2.
If battery voltage not present, eliminate open circuit between ignition/starting switch term. 15 and connection base term. 86.
If battery voltage present, check operation of alarm control unit.
Eliminate fault.

Continued on next picture page



Arrow = Ignition power-supply relay

1 = 8-pin plug connector



3. Connect voltmeter to connection base term. 86 (+) and term. 85 (-).
See top picture, arrow.

Switch on ignition.

Set value: Battery voltage

If battery voltage not present, eliminate open circuit in lead term. 85.

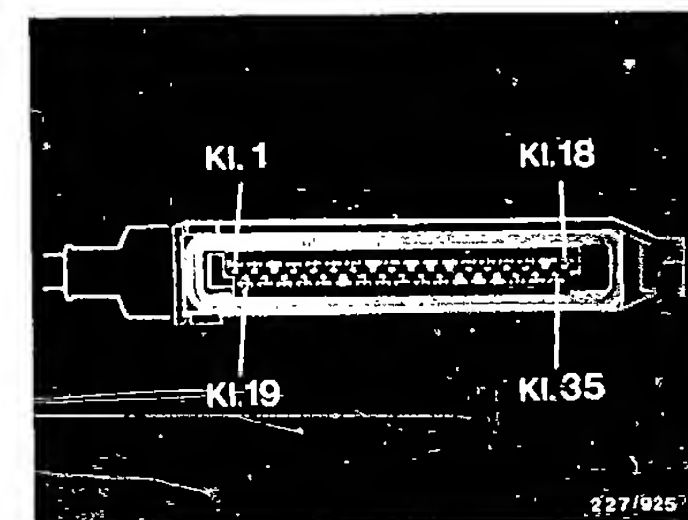
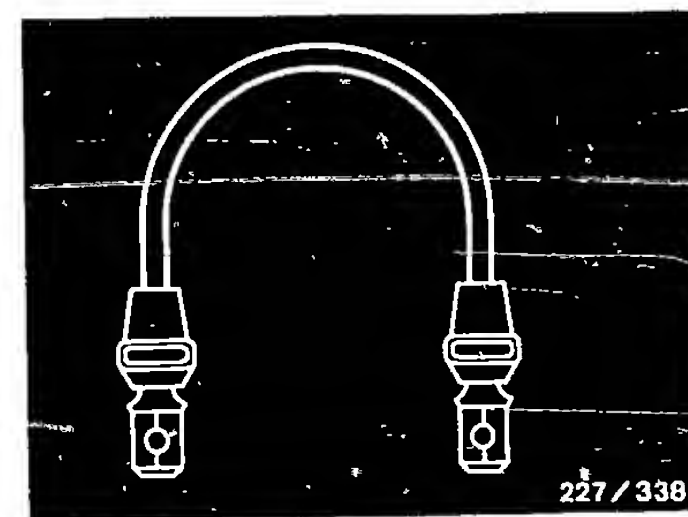
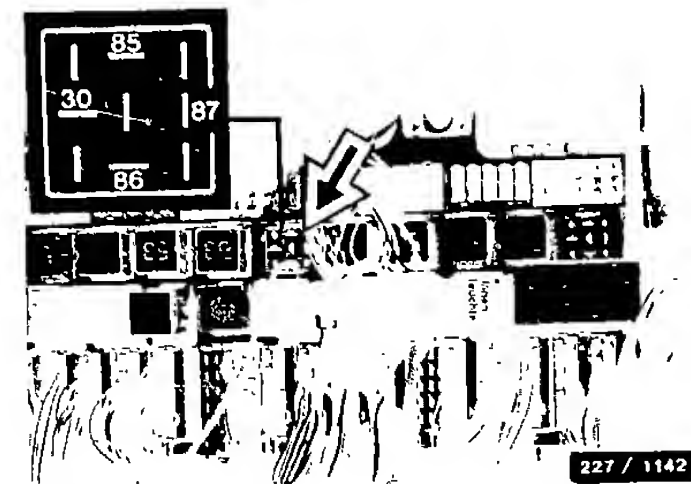
4. Connect connection base to term. 30 and term. 87 with auxiliary cable.
See center picture.

Connect voltmeter to EI-K control-unit plug term. 29 (+) and term. 18 (-).
See bottom picture.

If voltage not present, eliminate open circuit between positive battery terminal and connection base term. 30 or between connection base term. 87 and EI-K control-unit plug term. 29.

If points 1, 2, 3 and 4 O.K., replace ignition power-supply relay.

Return to trouble-shooting chart B04



TROUBLE-SHOOTING PROGRAM (6)

Check insulation of engine-speed and reference-mark sensor.

Disconnect EI-K control-unit plug and connect ohmmeter to term.23 and term.24 .
See top picture.

Set value: infinity Ω

Set value obtained?

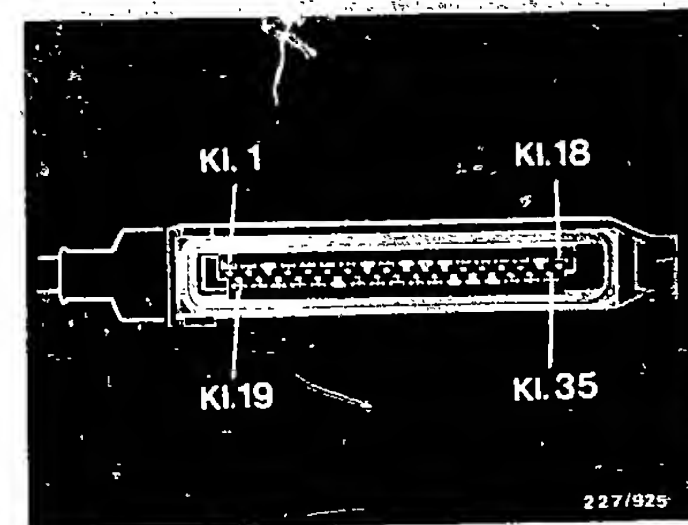
N>

Remove air-mass sensor.

Take apart plug connector of engine-speed and reference-mark sensor.
See bottom picture, arrow.

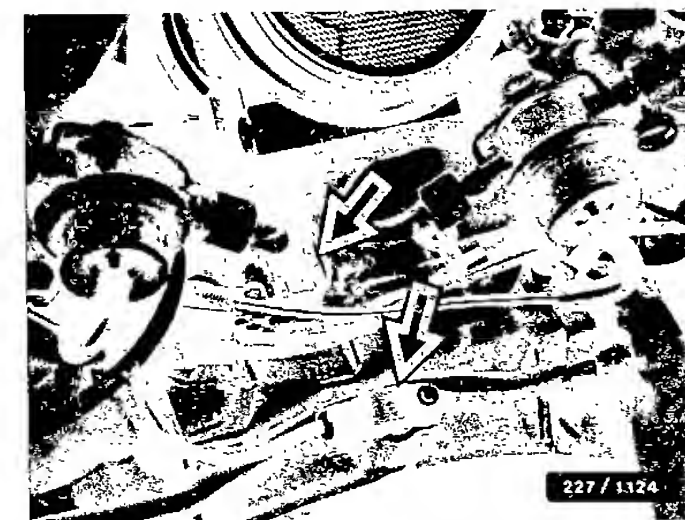
If set value now obtained, replace engine-speed and reference-mark sensor.

If set value not obtained, eliminate short circuit to ground between plug connector and EI-K control-unit plug.



EI-K control-unit plug

Arrow = Plug connector of engine-speed and reference-mark sensor



Return to trouble-shooting chart 804

TROUBLE-SHOOTING PROGRAM (7)

Check internal resistance of engine-speed and reference-mark sensor.

Disconnect EI-K control-unit plug and connect ohmmeter to term. 6 and term. 23.
See top picture.

Set value: See brief instructions.

Set value obtained?

N>

Remove LH air-mass sensor.

Take apart plug connector of engine-speed and reference-mark sensor.

See center picture, arrow.

Connect ohmmeter to:

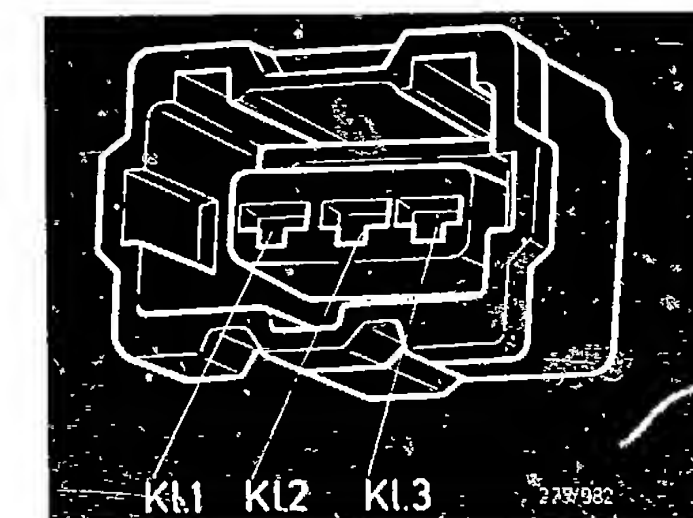
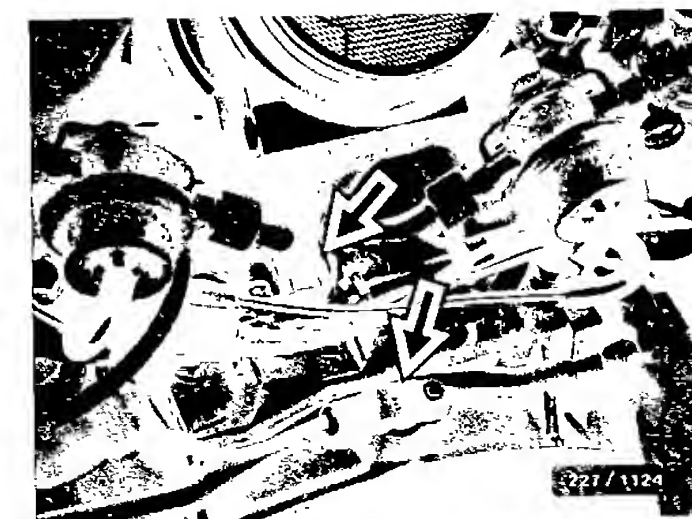
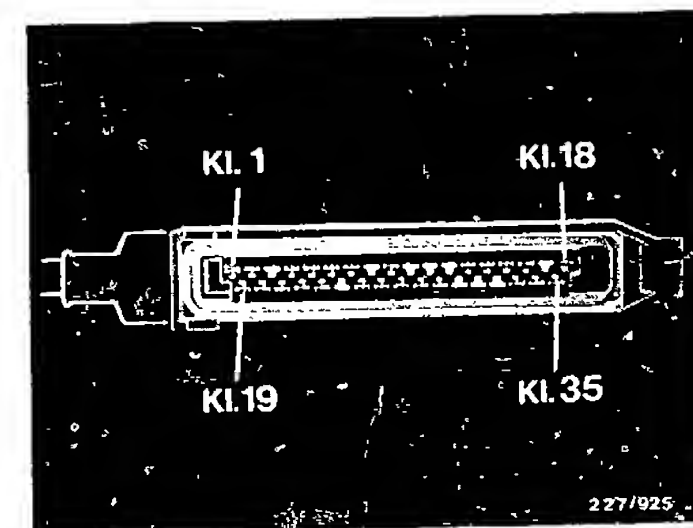
EI-K control-unit plug	Plug connector
Term. 23 and	Term. 1
Term. 6 and	Term. 2
Term. 24 and	Term. 3

Term. 23	and	Term. 1
Term. 6	and	Term. 2
Term. 24	and	Term. 3

Set value: Approx. 0 Ω in each case (continuity)

Eliminate open circuit.

If there was no open circuit, replace engine-speed and reference-mark sensor.



Return to trouble-shooting chart B04

TROUBLE-SHOOTING PROGRAM (8)

Check voltage at engine-speed and reference-mark sensor.

Disconnect EI-K control-unit plug.

Connect oscilloscope according to operating instructions with program switch in "special" position.

For example MOT 201:

Connect red and black clamps to EI-K control-unit plug term. 23 (+) and term. 6 (-). See top picture.

Start engine.

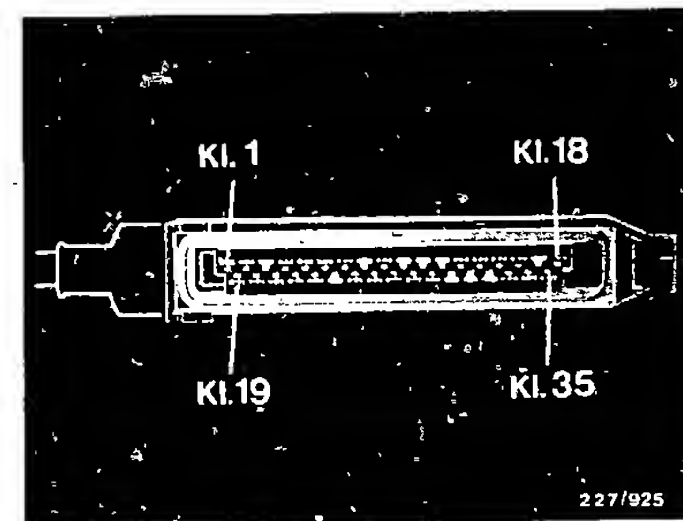
Oscilloscope must indicate an engine-speed-signal voltage. See bottom picture.

Set value: at least 2,5 V

Set value obtained?

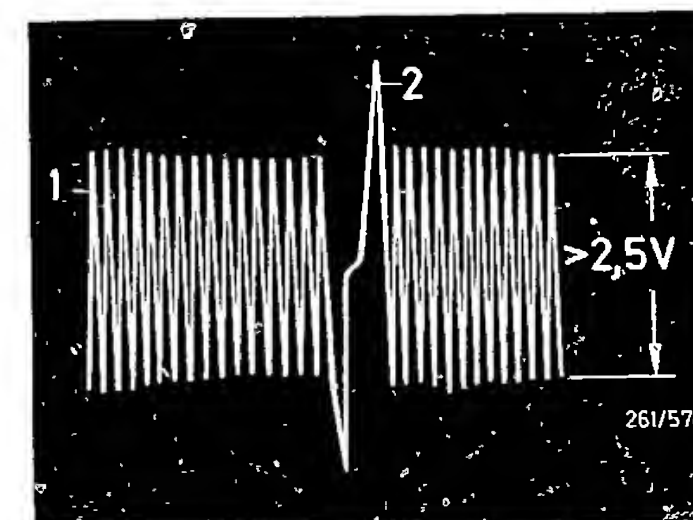
N>

Replace engine-speed and reference-mark sensor.



EI-K control-unit plug

1 = Engine-speed signal
2 = Reference-mark signal



Return to trouble-shooting chart B04

TROUBLE-SHOOTING PROGRAM (9)

Check energization of trigger boxes.

N>

Disconnect EI-K control-unit plug.

The following test must be performed on both trigger-box plugs.

EI-K control-unit plug connected.

Connect oscilloscope according to operating instructions with program switch in "special" position.

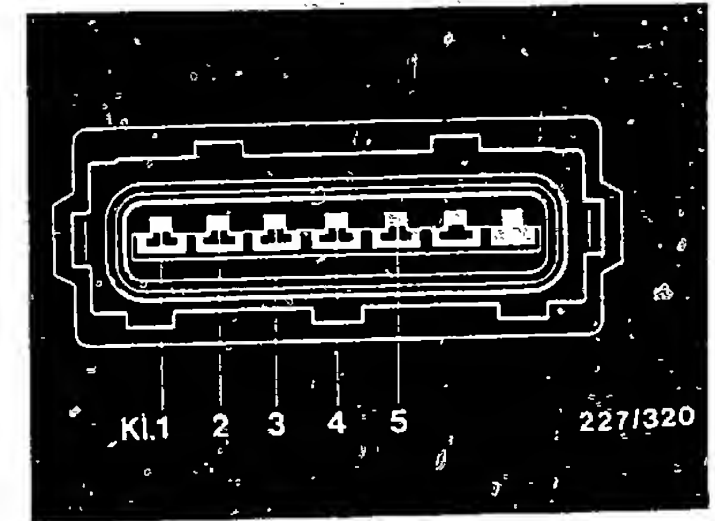
For example MOT 201:

Connect red and black clamps to disconnected trigger-box plug term. 5 (+) and term. 2 (-).

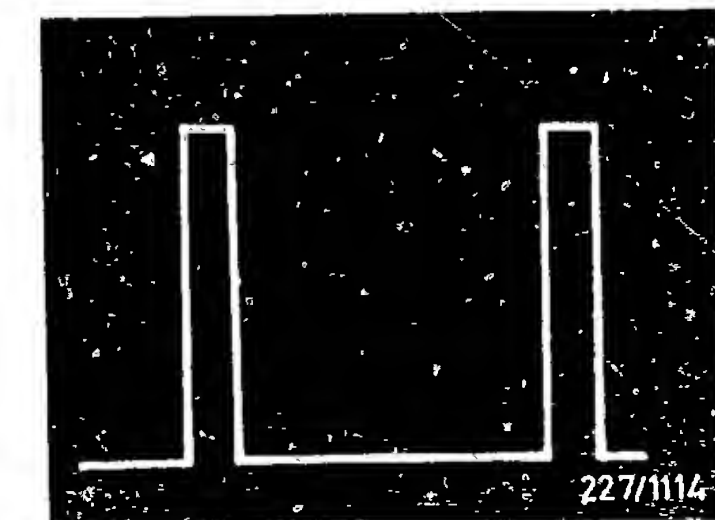
Start engine.

On each trigger-box plug, the oscilloscope must indicate a rectangular pulse. See bottom picture.

Rectangular pulse present?



Trigger-box plug



Rectangular pulse

Return to trouble-shooting chart B04

Continued on next picture page

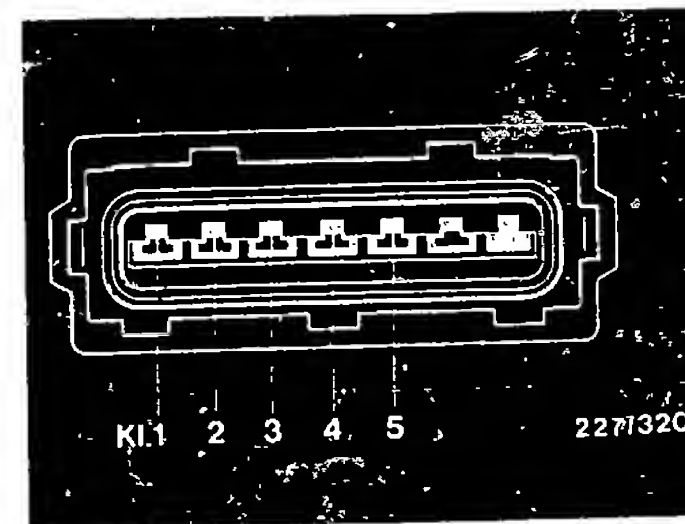
On the trigger-box plug on which no control signal is present, connect ohmmeter to trigger-box plug term. 5 and, consecutively, to EI-K control-unit plug term. 15 and term. 32.

Ohmmeter must indicate approx. $0\ \Omega$ (continuity) either for term. 15 or for term. 32.

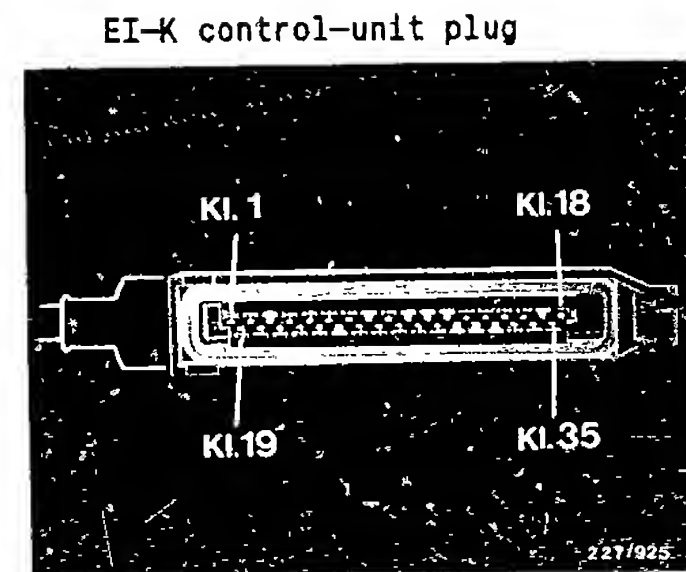
Eliminate open circuit between trigger-box plug and EI-K control-unit plug.

If there was no open circuit, replace EI-K control unit.

Return to trouble-shooting chart B04



Trigger-box plug



EI-K control-unit plug

TROUBLE-SHOOTING PROGRAM (10)

Test contact resistances (primary side).

Disconnect negative and positive cables from battery.
Pull off trigger-box plug.
See upper illustration.

Switch on ignition.

Test cables from positive battery terminal to trigger-box plug term.4 and cables from negative battery terminal to trigger-box plug term.2 for contact resistance.

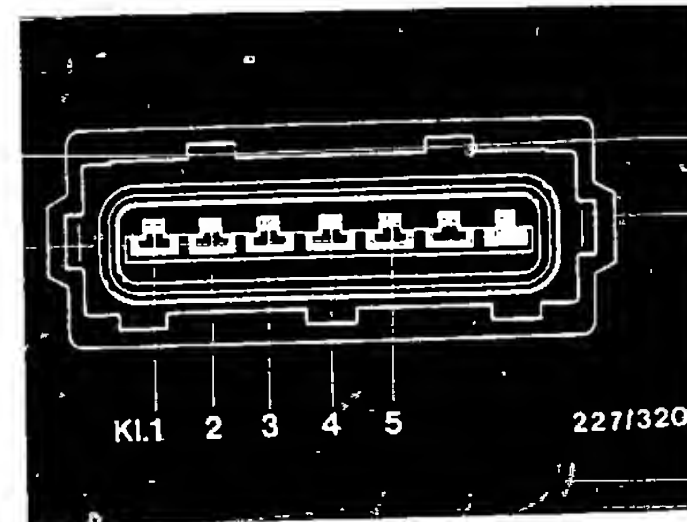
(Take resistance of test lead and test prods into account).

Set value: see brief instructions

Is set value obtained?

N>

Eliminate contact resistance.



8 = Trigger-box plug

Test cables from positive battery terminal to ignition coil term.15 as well as lead from ignition coil term.1 to trigger-box plug term.1 for contact resistance.
(Take resistance of test lead and test prods into account.)

Set value: see brief instructions

Is set value obtained?

N>

Eliminate contact resistance.

Return to trouble-shooting chart B04

TROUBLE-SHOOTING PROGRAM (11)

Check voltage at trigger box.

Take off trigger-box cover.

The following test must be performed on both trigger-box plugs.

Push back rubber sleeve on trigger-box plug and connect voltmeter to term. 4 (+) and term. 2 (-).

Operate engine at idle.

Set value: 12...14 V
or must be no more than
2 V below battery voltage.

Set value obtained?

N>

Disconnect negative and positive leads from battery; disconnect trigger-box plug.

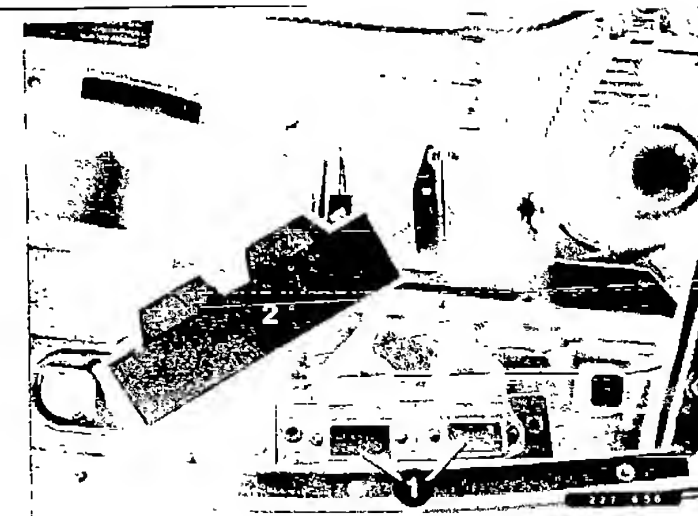
Switch on ignition.

Check for contact resistance in leads from positive battery terminal to trigger-box plug term. 4 including leads from negative battery terminal to trigger-box plug term. 2.

Set value: max. 0,3 Ω

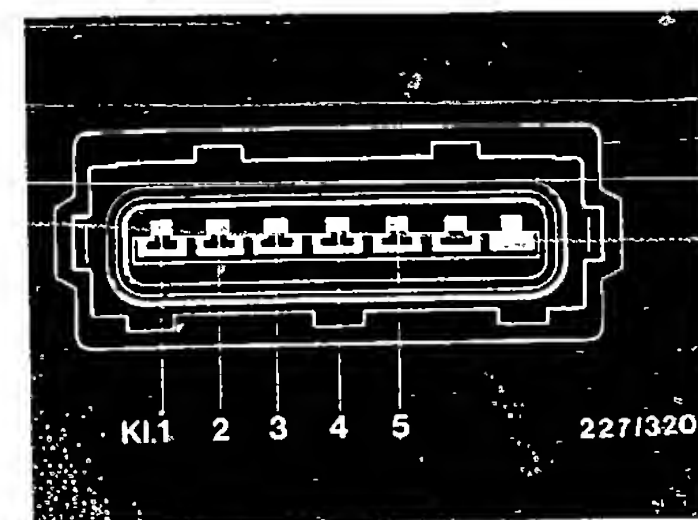
(Take resistance of test lead and test prods into account.)

Eliminate contact resistance.



1 = Trigger boxes
2 = Cover

Trigger-box plug



Return to trouble-shooting chart
B04

TROUBLE-SHOOTING PROGRAM (12)

V

Check voltage at ignition coil.

N>

Take off protective caps of
ignition coils.

The following test must be
performed on both ignition
coils.

Connect voltmeter to ignition
coil term. 15 and vehicle
ground.

Operate engine at idle.

Set value: equal to/greater than 10 V

Set value obtained?

Y

Disconnect positive lead from
battery.

Switch on ignition.

Check for contact resistance
in leads from positive battery
terminal to ignition coil term. 15.

Set value: max. 0,3 Ω

(Take resistance of test lead
and test prods into
account.)

Eliminate contact resistance

Return to trouble-shooting chart
B04

TROUBLE-SHOOTING PROGRAM (13)

Check primary voltage.
(If MOT series available).

N>

Take off protective caps of
ignition coils.

The following test must be
performed on both ignition
coils.

Connect oscilloscope (e.g.
MOT 201) together with pulse
shaper 1 684 463 154 to
ignition coil according to
operating instructions.

N o t e :

Measuring without pulse
shaper will result in incorrect
reading.

Operate engine at idle.

Set value: see picture/
brief instructions

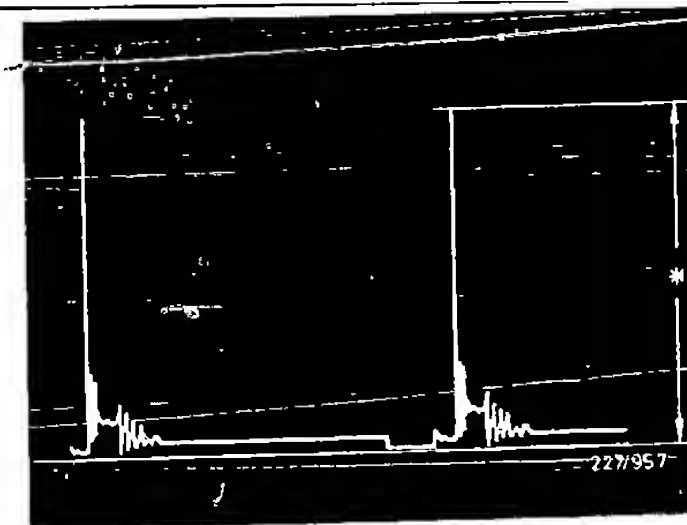
Set value obtained?

On the ignition coil on which
primary voltage was not
O.K., disconnect lead term. 1.

Disconnect both trigger-
box plugs.

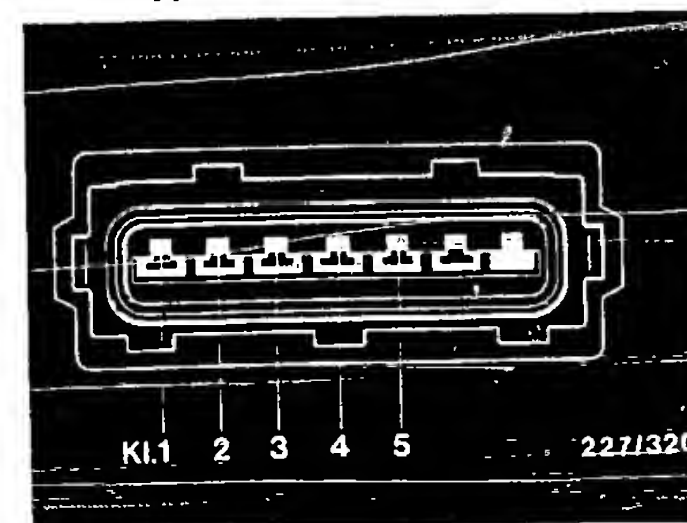
Connect ohmmeter to disconnected
lead from ignition coil term. 1
and consecutively to each
trigger-box plug term. 1.

On the trigger-box plug on
which the ohmmeter indicates
approx. 0 Ω (continuity),
replace the associated trigger
box.



* = See Brief Instructions

Trigger-box plug



Return to trouble-shooting chart
B04

TECHNICAL BULLETIN

DANGER OF ACCIDENT ON SEMI-
CONDUCTOR IGNITION SYSTEMS

|22|
VDT-I-227/102 En
03.1981

Supersedes Feb. 3, 1976 edition

Please be sure to pass this bulletin
together with VDE 0104/7.67 enclosed on to your
employees for their attention.

The increased demands made on their ignition
systems by modern engines, and the wish for freedom
from maintenance, led some time ago to manufacturers
starting to equip their vehicles with semi-conductor
ignition systems as original equipment.

In most cases, the performance of nearly all
makes of such systems is higher than that of
conventional systems, and further improvements are
to be expected. This means that semi-conductor
ignition systems have reached the point where
contact with "live" components or terminals
(whether on the primary side or the secondary side)
can prove fatal.

In this connection, we should like to point out
to you that the laws valid in your country
regarding work on high-voltage systems must
be adhered to when working on, or testing,
semi-conductor ignition systems.

As a matter of principle, when working on such
ignition systems, the ignition is to be
switched off.

Included in such work are the following operations:

- * Connection of engine testing equipment
(timing strobe, dwell-tach tester, ignition
oscilloscope etc.)
- * Replacement of ignition system components
(spark plugs, ignition coil, ignition
distributor, H.T. ignition cables etc.)

If it is necessary to switch on the ignition
in order to test the system or make adjustments
on the engine (to the carburetor, for instance),
then lethal voltages are present throughout
the entire system.

This means that the danger of accident exists
not only at the individual components in the
system (e.g. ignition distributor, ignition
coil, trigger box, ignition harness), but also
at the wiring harness (e.g. connection for the
tachometer, diagnostic connector), on terminals,
and on test equipment.

In addition, in the case of the capacitor-discharge
ignition system (CDI), danger of accident is also
present under the following circumstances:

- * Operation of the trigger box without the
ignition transformer.
- * At the trigger box, (removed), relatively
soon after it has been switched off
(capacitor discharge).

Below is a typical terminal diagram of a semi-
conductor ignition system, the dangerous
locations being marked with high-voltage arrows.

We would point out that all semi-conductor
ignition systems, even the older versions, are
to be regarded as dangerous in the sense as
defined by this bulletin.

EFFECTS OF ELECTRICAL AND ELECTRONIC SYSTEMS ON HEART PACEMAKERS

VDI-I-227/107 En
01.1981

e.g. Ignition systems, Jetronic, Motronic, ABS

Please ensure that this Bulletin is passed
on to your employees for their attention.

We have often been asked by some of our
customers whether or not patients with heart
pacemakers are endangered in any way by
ignition systems. This theme was recently
the subject of an examination carried out by
the Ignition System Development Department of
Robert Bosch GmbH in conjunction with Dr.
Thull, lecturer at the Central Institute for
Biomedical Technology at the University of
Erlangen-Nürnberg and Biotronic GmbH & Co.
of Berlin, a manufacturer of heart pacemakers.
The magazine "Biomedizinische Technik"
(5/80) published the results.

The most important discoveries in this practice
can be summarized from the examination report
as follows:

1. Heart pacemakers corresponding to the
latest state of the art are not affected
by radiation (electromagnetic fields) from
ignition systems.
2. With a stationary engine and the ignition
switched off, the heart pacemaker is not
affected by any part of the ignition system,
even when unintentionally touched. Main-
tenance work in the engine compartment, for
example; can then be carried out without
any danger.

- 1 = Battery
- 2 = Ignition/starting switch
- 3 = Trigger box
- 4 = Resistor
- 5 = Ignition distributor
- 6 = Ignition coil
- 7 = to starting motor term. 15a
- 8 = to tachometer connection
or diagnostic plug
or TD terminal

Published by:

Robert Bosch GmbH
Division KH
After-Sales Service Department for
Training and Technology (KH/VSK)

Please direct questions and comments
concerning the contents to our authorized
representative in your country.

3. With the engine running or stationary with the ignition switched on, touching current-carrying parts of the ignition system, as well as parts of any other electrical system, presents a certain danger for everybody. The heart pace-maker can here be affected under certain conditions (voltage, current and frequency). Patients with heart pace-makers should therefore at all costs avoid touching current-carrying parts of electrical systems.

4. Furthermore, patients with heart pace-makers are more inclined to psychic shock effects than other people, even when they receive just a harmless electric shock, because many such patients are conscious of the increased danger to the cardiac activity.

We therefore consider it inadvisable for patients with heart pacemakers to be employed in workshops or on vehicles where ignition systems are being tested or repaired. If any members of your staff have heart pacemakers, please introduce the necessary measures.

We would like to add that heart pacemakers are not expected to be affected in any way by interference from other electronic products and systems which we manufacture, such as the Antiskid System (ABS), Jetronic, Motronic, because the much greater radiation intensity of the ignition systems examined in normal use has not caused any interference to heart pacemakers corresponding to the latest state of the art.

If you should receive questions on this matter from customers, please inform them accordingly.

Published by:

Robert Bosch GmbH
Division KH
After-Sales Service Department for
Training and Technology (KH/VSK)

Please direct questions and comments concerning the contents to our authorized representative in your country.

TECHNICAL BULLETIN

NEW DESIGNATIONS FOR IGNITION SYSTEMS

VDI-I-227/108 En
01.1983

Supersedes 5.1981 edition

The introduction of new ignition systems has made it necessary to reclassify all designations.

The designations listed below will be used immediately in KH workshop and sales literature.

Designation	Abbreviated code	Meaning	Switching	Ignition ctrl. and spark adv.	High-voltage dist.
Coil ignition	ZS (CI)		Mechanical (breaker points)	Mechanical (ignition distributor)	Mechanical (ignition distributor)
Transistorized coil ignition	TSZ-K (TCI-c)	K=breaker-triggered	Electronic (trigger box)	Mechanical (ignition distributor)	Mechanical (ignition distributor)
Trigger box with conventional circuit techniques	TSZ-I * (TCI-i)	I=Induction-type pulse gen.	Electronic (trigger box)	Mechanical (ignition dist.)	Mechanical (ignition dist.)
	TSZ-H (TCI-h)	H=Hall generator	Electronic (trigger box)	Mechanical (ignition dist.)	Mechanical (ignition dist.)

Designation	Abbreviated code	Meaning	Switching	Ignition ctrl. and spark adv.	High-voltage dist.
Transistorized ignition	TZ-I * (TI-i)	I=Induction-type pulse gen.	Electronic (trigger box)	Mechanical (ignition distributor)	Mechanical (ignition distributor)
(Trigger box in hybrid technique)	TZ-H * (TI-h)	H=Hall generator	Electronic (trigger box)	Mechanical (ignition distributor)	Mechanical (ignition distributor)
Breakerless semi conductor ignition with or without knock control	EZ (EI) (EZ-K) (EI-k)	K=Knock control	Electronic (trigger box or control unit)	Electronic (control unit)	Mechanical (ignition distributor or high-voltage distributor)
Distributor-less ignition with or without knock control	VZ (FEI) (VZ-K) (FEI-k)	K=Knock control	Electronic (control unit)	Electronic (control unit)	Electronic (dual-spark ignition coil, or 1 ignition coil for each spark plug)

* Note:

The ignition system can also be equipped with a DLS unit (digital idle stabilization) or with an ELS unit (electronic idle stabilization) or with an ESV unit (electronic ignition retardation).

MOTOR VEHICLE SERVICE INFORMATION

INCORRECT DISPLAY OF ROTATIONAL SPEED AND DWELL ANGLE ONLY WITH TRIGGER BOXES 0 227 100 .. (TCI-l, TCI-h) WITH CURRENT LIMITATION VDT-I-Gen. 030 En 02.1981
Supersedes ed. 6.1980

For additional information, see VDT-I Gen. 032 En

1. General

In comparison with conventional ignition systems, transistorized ignition systems with current limitation have different primary voltage characteristics. During the dwell period, the voltage at terminal 1 of the ignition coil may assume values from 1.5 V to battery voltage (or greater). This may lead to an incorrect display of rotational speed and dwell angle when testing the ignition system. However, there is no functional defect in the ignition system, and, for this reason, the trigger box must not be replaced. Incorrect displays may occur with the testers listed below:

MOT 001.00	Rotational-speed	KTE 001.00
001.01	display O.K. with	001.02
001.02	these testers	001.03
001.04		
002.00		

By now, the following vehicles may be fitted with breakerless ignition systems with current limitation:

Audi	(Bosch/Fairchild ignition system)	Mazda	(Mitsubishi ignition system)
BMW	(Bosch ignition system)	Mitsubishi	(Mitsubishi ignition system)
Citroen	(Delco ignition system)	Nissan	(Hitachi ignition system)
Fiat	(Delco ignition system)	Datsun	(Bosch ignition system)
Ford	(Delco ignition system)	Peugeot	(Bosch ignition system)
General Motors	(HEI ignition system)	VW	(Bosch/Fairchild ignition system)
		Bosch transistorized ignition system for retrofitting	
		0 227 100 920	

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2. Test instructions

2.1 Rotational speed

Incorrect rotational-speed display can be recognized as follows:

If one starts at the idle speed and slowly increases the engine speed, then the incorrect display can be recognized by an abrupt reduction in the rotational-speed display (e.g. from 2400 min⁻¹ to 1200 min⁻¹).

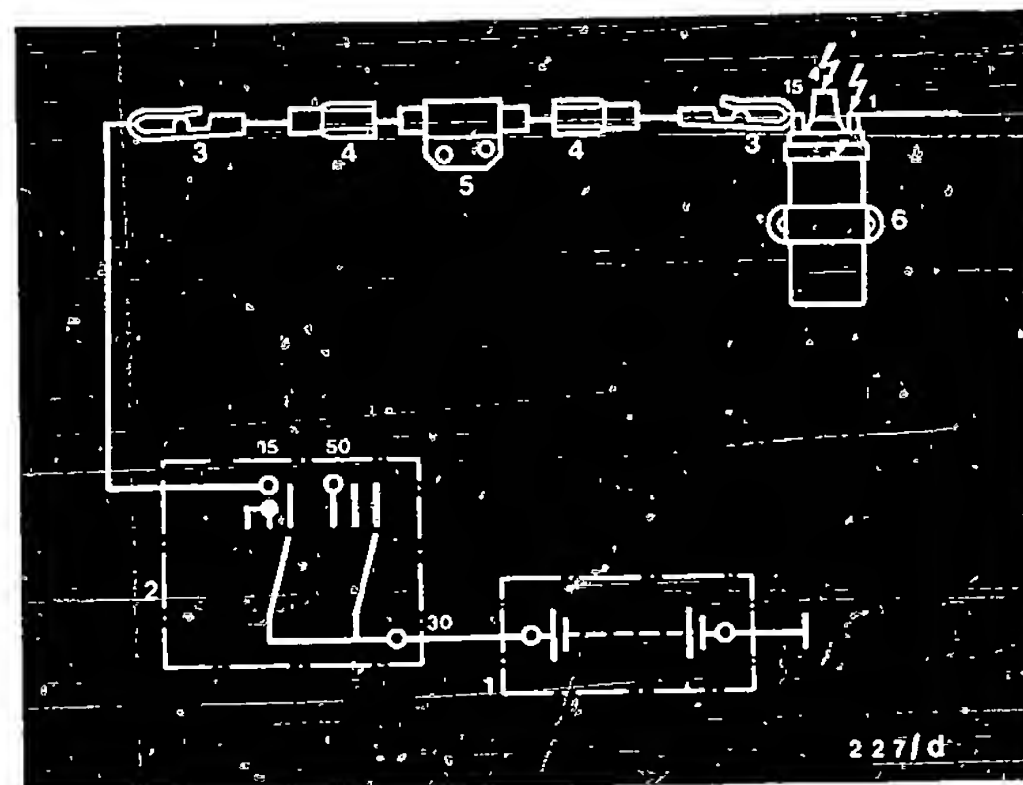
It is, however, possible to attain correct rotational-speed measurements:

Connect a ballast resistor of 0.9 or 1.0 Ohms (see Fig.) in series in the line to term. 15 of the ignition coil (take care not to cause a short circuit). After the rotational-speed measurement, the ballast resistor must be removed (otherwise starting difficulties and misfiring). Connect tester as per operating instructions.

Suggestion for user manufacture

Required parts:

1 ballast resistor 0.9 Ohms	Part no. 0 227 900 002
or	
1 ballast resistor 1.0 Ohms	Part no. 0 227 900 101
2 blade receptacles	Part no. 1 901 355 881
e.g. approx. 0.2 m cable, 1.5 mm ² e.g.	Part no. 6 210 150 150
2 insulated clips	Commercially available



- | | |
|------------------------------|----------------------|
| 1 = Battery | 4 = Blade receptacle |
| 2 = Ignition/starting switch | 5 = Series resistor |
| 3 = Terminals | 6 = Ignition coil |

Danger arrows: Warning: 400 V...25 KV

2.2 Dwell angle

The dwell angle is electronically controlled.
The dwell angle is no longer measured.

2.3 Ignition timing

Is correctly indicated. Tester connections according to operating instructions.

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MOTOR-VEHICLE SERVICE INFORMATION

MOTORTESTER CONVERSION

VDT-I-Gen. 032 En

Incorrect indication of engine speed,

06.1980

dwelling angle and ignition point

only with trigger boxes

0 227 100 .. (TCI-I, TCI-H) with current limitation

For additional information see

VDT-I-Gen. 030 of 06.1980

Concerns: Motortester EFAW 268

268 S 10

269

214 B

AE 2000

1. General

Please arrange for above-quoted motor-testers in your workshop as well as at your customers (e.g. motor-vehicle workshops, petroleum companies, gas stations, vocational schools etc.) to be converted. Conversion is subject to payment and is performed by the K7 after-sales service of the responsible BG. The standard time is 15 work units (with installation of switch).

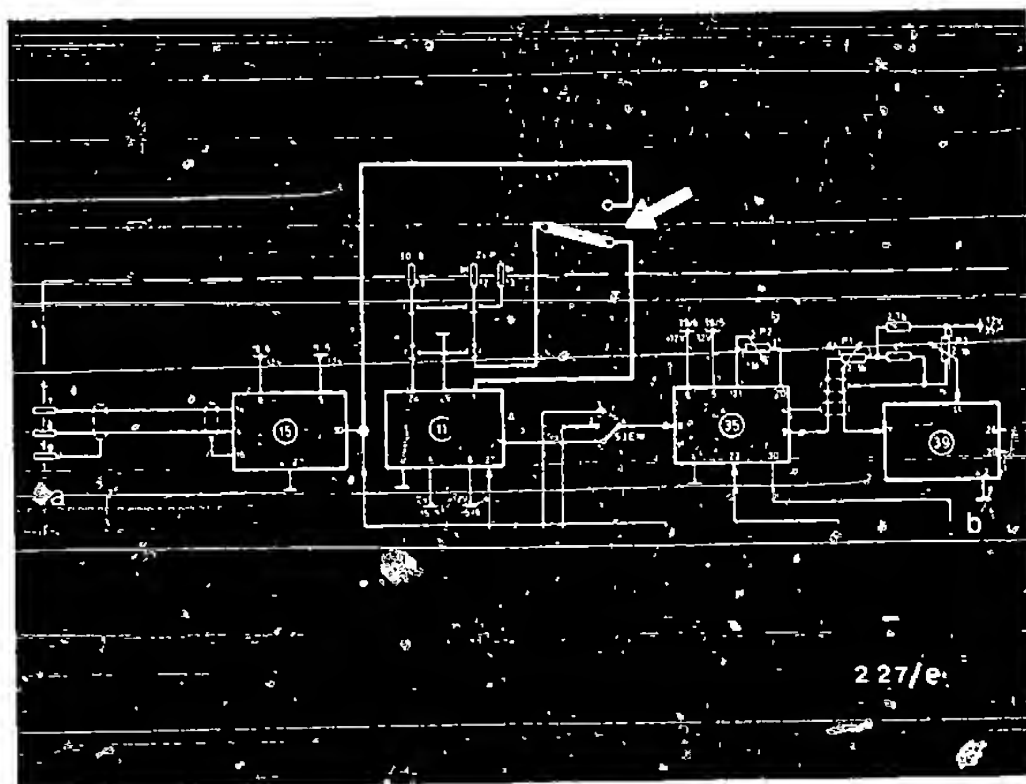
2. Why convert motortesters?

Transistorized ignition systems with current limitation have a different primary-voltage characteristic from conventional ignition systems. During the dwell period, the voltage at terminal 1 of the ignition coil may assume values between 1.5 V and battery voltage (or greater), which, when checking the ignition system, may lead to an incorrect indication of engine speed and dwell angle and to incorrect triggering of the counter.

There is, however, no functional defect in the ignition system, and, for this reason, the trigger box must not be replaced. Since, with the above-listed motortesters, the timing strobe is triggered by the signal-path dwell-angle meter, this incorrect triggering also leads to incorrect flashing and thus to an incorrect display of the advance angle.

3. Conversion measures

The situation is to be remedied by modifying the wiring of the testers so that the timing strobe is triggered by the clamp-on induction pickup and the pulse shaper stage.

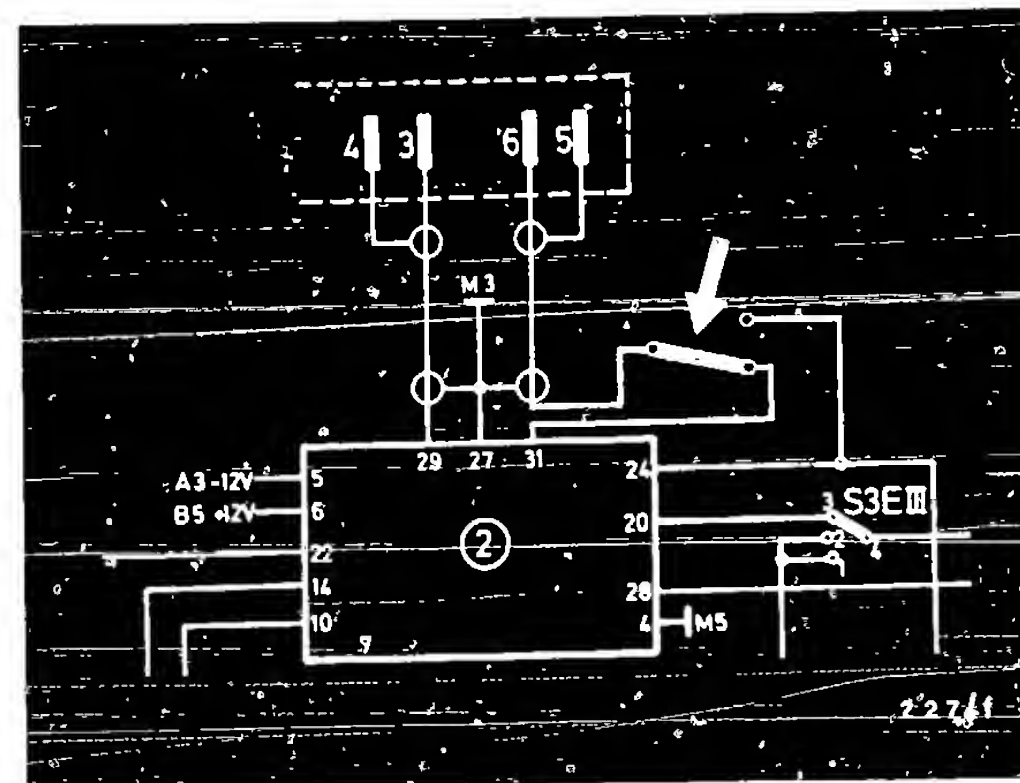


a = Clamp-on induction pickup
b = (Extract from WJF 508/1, Page 53)

EFAW 268, 268 S 10, 269, AE 2000

Remove the line of the ZLP from pin 31 of printed board 11 (coupling stage) and connect to pin 30 of printed board 15 (pulse shaper stage) via a switch with change-over contact (e.g. 0 341 500 803).

In addition, a new line must be connected from pin 31 of printed board 11 to the other contact of the switch with change-over contact.
Arrow points to switch with change-over contact.



(Extract from WJF 503/1, Page 64))

EFAW 214 B

Remove the line from terminal 6 of printed board 16 to pin 31 of printed board 2 (coupling stage) and connect to pin 24 of the same printed board via a switch with change-over contact (e.g. 0 341 500 803).

In addition, a new line must be connected from pin 31 of printed board 2 to the other contact of the switch with change-over contact.

Arrow points to switch with change-over contact.

By fitting the switch with change-over contact in the front panel of the motortester, it is possible to switch over from standard ignition systems to those with current limitation. We recommend that the switch positions be marked correspondingly:
e.g. "Standard" - "Current limitation".
These conversion measures have already been published in the K7 information sheet KJF 28/7911.

4. Test instructions

4.1 Standard ignition systems

Switch position: "Standard".
All other tester connections as per operating instructions.

4.2 Ignition systems with current limitation

Switch position: "Current limitation".
In order to trigger the timing strobe, the induction-type pulse generator (clamp-on pickup or red pickup) must always be connected during the measurement.

The selector switch for ignition systems built into the motortester must be switched to standard coil ignition (not to TCI) with these ignition systems.

All other tester connections as per operating instructions.

The dwell angle is electronically controlled. A measurement of the dwell angle is no longer performed.

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MOTOR VEHICLE SERVICE INFORMATION

TESTS ON ELECTRONIC IGNITION
SYSTEMS (TCI, TI)
TESTER INSTRUCTIONS

VDT-I-Gen. 035 En
03.1981

The following tests are listed in older and current Tester operating instructions or in "Trouble-shooting with the oscilloscope":

- * "Separate ignition coil test"
(Concerns EFAW 213, 214, 268, AE 2000)
- * Calculating the "ignition voltage reserve"
(Concerns EFAW 213, 214, 268, AE 2000 and MOT series).
- * "Intensified insulation test"
(Concerns EFAW 213, 214, 268, AE 2000 and MOT series).

Nowadays, transistorized ignition systems deliver more than 30,000 V secondary voltage.

To avoid damage to ignition coil, ignition cable and ignition distributor by voltage flashovers, the tests listed above should not be carried out on transistorized ignition systems.

The contents of this Service Information has already been published in the K7 Information K7-VJF 17/8012.

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